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PAGE'S WEEKLY

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PAGE'S WEEKLY

Miscellaneous

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97, QUEEN VICTORIA ST., LONDON, E.C.

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See our Advertisement appearing January 20th, page 45.

HEAD OFFICES—Oriel House, Farringdon Street, LONDON, E.C.
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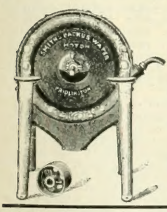

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Will drive any class of Machinery, and work on 15 lb. pressure.

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Chartered Patent Agents.

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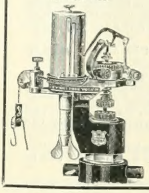

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PAGE'S WEEKLY

Contracts

CONTRACTS.

ASYLUMS COMMITTEE OF LONDON COUNTY COUNCIL.

The Asylums Committee of the London County Council are prepared to receive TENDERS for the INSTALLATION of HEATING, VENTILATING, and HOT-WATER PLANT at the Long Grove Asylum, Epsom, Surrey, now in course of erection.

Instructions for Tender and forms of Tender and Contract, with specification and schedules thereto annexed, together with plans and cover, can be obtained from the Clerk of the Committee, No. 6, Waterloo Place, London, S.W., on or after Thursday, the 1st December proximo, on payment of a deposit of £5 for each copy. The amount deposited will, after the Committee have come to a decision upon the Tenders received, but not before, be returned to the tenderer, provided he shall have sent in a *bonâ fide* Tender and shall not have withdrawn the same.

Tenders must be on the printed form, and must be accompanied by the form of contract and schedules thereto and bond.

The Tender and accompanying documents, completed in accordance with the instructions, must be enclosed in the authorised sealed cover, endorsed "Tender for Heating, Long Grove Asylum," and be delivered at the Office of the Committee, 6, Waterloo Place, London, S.W., on or before Monday, the 23rd January, 1905, after which no Tender will be received.

Any Tender not made on the printed form, or not filled up and complete in every particular in accordance with the instructions, will be rejected.

The Committee do not bind themselves to accept the lowest or any Tender.

The contractor will have to enter into a bond in the penal sum of £2,000, with two approved sureties, each in the sum of £1,000, as security for the due performance of the contract.

R. W. PARTRIDGE,
Clerk of the Asylums Committee.

Asylums Committee Office,
6, Waterloo Place, London, S.W.,
November 16th, 1904.

COUNTY OF LONDON—THE LONDON COUNTY COUNCIL (NORTHERN) TRAMWAYS.

TO ENGINEERS, CONTRACTORS, AND OTHERS.

The London County Council invite TENDERS for the ROADWORK and PLATE-LAYING required for the Construction, for electrical traction on the conduit system, of the authorised Tramway in Rosebery Avenue, and of a portion of the authorised Tramway in St. John Street Road, in the Metropolitan Boroughs of Holborn and Finsbury.

The total length of the above-mentioned line is equivalent to about 1¾ miles of single track.

The Contractor will be required to use the track rails with their fastenings and the slot rails, which will be furnished by the Council under another contract, but all the remaining metal work and other materials, and all the special work at junctions, crossings, crossovers, &c., will be included in the contract.

Persons desiring to submit Tenders may, on and after Friday, 30th December, 1904, obtain the drawings, specification, form of Tender, and other particulars on application to the Council's Chief Engineer, at the County Hall, Spring Gardens, S.W., upon the payment to the Cashier of the Council of the Sum of Five Pounds. This amount will, after the Council or its Committee shall have come to a decision upon the Tenders received, but not before, be returned to the tenderer, provided he shall have sent in a *bonâ fide* Tender and shall not have withdrawn the same, but in no case will the fee be returned unless a *bonâ fide* Tender is submitted.

Full particulars of the work may be obtained on application at the County Hall, previously to the payment of the fee for the specification, &c.

Tenders must be upon the official forms, and the printed instructions contained therein must be strictly complied with.

The contractors will be bound by the contract to pay to all workmen (except a reasonable number of legally bound apprentices) employed by them wages at rates not less and to observe hours of labour not greater than the rates and hours set out in the Council's list, and such rates of wages and hours of labour will be inserted in and form part of the contract by way of schedule.

Each Tender is to be delivered at the County Hall in a sealed cover, addressed to the Clerk of the London County Council, Spring Gardens, S.W., and marked "Tender for Roadwork and Plate-laying—L.C.C. Tramways."

No Tender will be received after 10 o'clock a.m. on Tuesday, the 24th January, 1905.

Any Tender which does not comply with the printed instructions for Tender may be rejected.

The Council does not bind itself to accept the lowest or any Tender, and it will not accept the Tender of any person or firm who shall on any previous occasion have withdrawn a Tender after the same had been opened, unless the reasons for the withdrawal were satisfactory to the Council.

G. L. GOMME,
Clerk of the London County Council.

County Hall, Spring Gardens, S.W.,
December 28th, 1904.

BOROUGH OF CAMBERWELL.

TO BRIDGE BUILDERS, BUILDERS, CONTRACTORS, AND ENGINEERS.

The Council is prepared to receive

TENDERS FOR THE CONSTRUCTION and ERECTION of a FOOTBRIDGE and APPROACH ROADS, &c., over the Surrey Canal, between Neate Street and St. George's Road, Camberwell, in accordance with the Plans and Specifications prepared by the Borough Engineer, Mr. WILLIAM OXTOBY.

Tenders, on forms for the purpose, are to be delivered, duly marked and sealed and addressed to the Works and General Purposes Committee, not later than 6.30 p.m. on Monday, January 23rd, 1905, after which time no Tender will be received. Persons tendering should be in attendance.

A deposit of £2 2s. will be required for a copy of the Specifications and Quantities, the sum to be returned on receipt of a *bonâ fide* Tender. Further particulars and Forms of Tender, &c., may be obtained at the Town Hall, Camberwell, between the hours of Ten a.m. and Four p.m., Saturday Ten a.m. to One p.m.

The Council does not bind itself to accept the lowest or any Tender. Persons tendering must comply with the Conditions as regards rates of wages and hours of labour as contained in the Form of Contract.

C. WILLIAM TAGG,
Town Clerk.

December 19th, 1904.

BOROUGH OF KIDDERMINSTER WATER SUPPLY—CONTRACT No. 3.

The Corporation of Kidderminster is prepared to receive TENDERS for the ERECTION of ENGINE-HOUSE, BOILER-HOUSE, and CHIMNEY STACK, together with the PROVISION, LAYING, and JOINTING of about 800 YARDS of 10 in. CAST IRON DISTRIBUTING MAIN, and other works in connection therewith.

Plans and specifications may be seen, and bills of quantities obtained, at the Offices of the Engineers, Messrs. Willcox and Raikes, of Union Chambers, 63, Temple Row, Birmingham, on or after December 30th, upon payment of a deposit of £5 5s., which will be refunded on receipt of a *bonâ fide* Tender and the return of all documents.

Sealed Tenders, on the forms supplied by the Engineers, and endorsed "Kidderminster Water Supply.—Contract No. 3," to be delivered at my office not later than Twelve noon on January 20th, 1905.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
JAMES MORTON,
Town Clerk.

Town Hall, Kidderminster,
December 19th, 1904.

PORT ELIZABETH MUNICIPAL CORPORATION ELECTRICITY SUPPLY.

The Agents of the Municipal Corporation of Port Elizabeth, South Africa, are prepared to receive TENDERS for the EXECUTION of the following WORKS in connection with the Corporation Electricity Supply undertaking: Section A. Boiler-house Plant—Three marine type water-tube boilers, superheaters, economisers, chimneys, pipework, tanks, electrically driven feed pumps and accessories. Section B. Engine-room Plant—Three 400 kilowatt steam turbines and dynamos, surface condensers, electrically driven pumps, pipe work and accessories. Section C. Electricity Supply Mains—Cables, pillars, boxes and accessories. Section D. Accumulators and Boosters—Battery of accumulators, reversible boosters, milking booster and accessories. Section E. Switchboard and Instruments—Main and auxiliary switchboards, instruments, apparatus and accessories. Section F. Crane—Ten-ton overhead hand travelling crane. Section G. Public Lighting—Ten-ampère arc lamps, three-ampere enclosed arc lamps, Nernst lamps, arc pillars, brackets and accessories. Section H. Meters—Motor and electrolytic meters. Section I. Workshop Equipment—Machine tools, motor, fitters', smiths', and joiners' tools, lifting gear, mains department equipment.

Applicants must state for which section or sections they wish to tender, in order that the requisite drawings may be forwarded to them. Tenderers are at liberty to tender for any one of or for all the sections, but not for part of a section. The specification, with terms and conditions, forms of tenders and form of contract, may be obtained from the undersigned, on making a deposit of £5 5s., which sum will be refunded on the return of the specification filled up with a *bonâ fide* Tender. Extra copies of the specification may be obtained by *bonâ fide* tenderers at a charge of Five Shillings per copy, which will not be refunded. Tenders (sealed and marked "Tender for Electrical Plant") must be delivered to the undersigned before noon on Monday, January 16th, 1905.

The Municipal Corporation does not bind itself to accept the lowest or any Tender.

DAVIS and SOPER,
Agents to the Municipal Corporation of Port Elizabeth, South Africa.

54, St. Mary Axe, London, E.C.

PAGE'S WEEKLY

Contracts

URBAN DISTRICT OF ERITH.
TRAMWAYS.
The Erith Urban District Council invite

TENDERS FOR:—

CONTRACT No. 5.
OVERHEAD LINE EQUIPMENT, POLES, &c.
CONTRACT No. 6.
UNDERGROUND FEEDER CABLES, BOXES, &c.
CONTRACT No. 7.
ROTARY CONVERTERS, TRANSFORMERS and MOTOR BOOSTER.
CONTRACT No. 8.
MAIN HIGH and LOW-TENSION SWITCHBOARDS, CABLE CONNECTIONS, &c.

Copies of specifications with forms of Tender, general conditions, &c., may be obtained from the undersigned, on depositing the sum of £5, which sum will be returned on receipt of a *bonâ fide* Tender.

Plans and specifications may be seen at, but not obtained from, the offices of Messrs. HAWTAYNE AND ZEDEN, of 9, Queen Street Place, London, E.C., the Consulting Engineers to the Council.

The contract will provide that the Contractor shall pay not less than the standard rates of wages, and observe the conditions of labour customary in the district where the work is executed.

Persons tendering are at liberty to Tender for either or all of the contracts, but not for part only of one contract.

Tenders, sealed and marked "Tramways Contract No. ..... Tender," to be addressed to the undersigned, and delivered at or before Twelve o'clock Noon on Monday, the 9th day of January, 1905.

Dated this 9th day of December, 1904.

CHARLES H. FRY,
Clerk of the Council.

District Council Offices, Erith, Kent.

BOARD OF PUBLIC WORKS.—NOTICE TO CONTRACTORS.

Sealed TENDERS, addressed to the undersigned, will be received up to, but not later than, Ten o'clock a.m. on the 11th day of February, 1905, for EXECUTING certain WORKS at Downies Bay, County Donegal, viz.: An EXTENSION of the existing PIER, DREDGING, ROCK EXCAVATION, &c., according to the plans to be seen at the Coastguard Station, Mulroy, Larganreagh, Letterkenny, County Donegal, and at this Office, where the specification, schedule, form of contract, and printed form of Tender can be had.

The Board will not be bound to accept the lowest or any Tender.

By order,
H. WILLIAMS,
Secretary.

Office of Public Works, Dublin,
December 22nd, 1904.

BOROUGH OF SWINDON.—ELECTRICITY AND TRAMWAYS DEPARTMENT.

LANCASHIRE BOILER, &c.

The Corporation of Swindon invite TENDERS for the SUPPLY and ERECTION of ONE 30 ft. by 8 ft. LANCASHIRE BOILER, with downtake superheater, steam, exhaust, and feed piping, &c.

Copies of the general conditions, specification, and forms of Tender may be obtained on application to the Engineer and Manager, Mr. J. G. GRIFFIN, A.M.I.E.E., Electricity Works, Swindon, on payment of a deposit of One Guinea for each copy, which will be returned on receipt of a *bonâ fide* Tender.

Extra copies may be obtained at 5s. each.

The firm whose Tender is accepted will be required to find two responsible sureties, and to enter into a contract to be prepared by and to contain such clauses as the Town Clerk may deem necessary.

Tenders on the prescribed form, and accompanied by the specification and general conditions intact, and endorsed "Tender for Lancashire Boiler," to be delivered to the undersigned before 10 a.m. on Tuesday, January the 24th next.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
ROBERT HILTON,
Town Clerk.

Town Hall, Swindon,
December 23rd, 1904.

JOHANNESBURG MUNICIPAL TRAMWAYS.
The Council is prepared to receive

TENDERS FOR:—

VIGNOLES RAILS.
FISHPLATES.
ANGLE STEEL GUARD RAILS, BOLTS, NUTS, COACH SCREWS and DOG SPIKES.

General conditions, specifications, and forms of Tender are now being issued at the Offices of the Town Clerk of Johannesburg. They may be seen on and after Friday, December 30th, at the Offices of the Council's Consulting Engineers, Messrs. MORDEY AND DAWBARN, 82 Victoria Street, Westminster, S.W., and may be obtained from them on payment of Five Guineas, which will be returned on receipt of a *bonâ fide* Tender.

Tenders are to be addressed to Messrs. MORDEY AND DAWBARN, 82, Victoria Street, Westminster, S.W., and must reach them not later than Noon on Thursday, January 26th, 1905.

The Council does not bind itself to accept the lowest or any Tender, and is not responsible for the cost of Tendering.

R. FEETHAM, Town Clerk.

BOROUGH OF DOVER.—LIGHT RAILWAY.

The Town Council invite TENDERS for the CONSTRUCTION of about 1¼ MILES of DOUBLE LINE of LIGHT RAILWAY to River, commencing by a junction with the Dover Corporation Tramways at Buckland, including the SUPPLYING and LAYING of STEEL GIRDER RAILS, FISH-PLATES, TIE BARS, &c., GUERNSEY GRANITE SETTS, and JARRAH WOOD PAVING BLOCKS on a bed of Cement Concrete; also CREOSOTED DEAL SLEEPERS, &c., STEEL POLES, and OVERHEAD EQUIPMENT, COPPER BONDS, &c., in One Contract.

A form of Tender, specification, and bill of quantities, may be obtained on payment of Five Guineas (returnable on receipt of a *bonâ fide* Tender if the Tender is not accepted) and conditions and plans inspected at the Office of the Borough Engineer, Maison Dieu House, Dover, on and after January 3rd, 1905, during office hours.

Tenders, endorsed "Tender for Light Railway," to be sent to me on or before noon on Monday, the 16th January, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

WOLLASTON KNOCKER,
Town Clerk.

Town Clerk's Office, Castle Hill House,
Dover, December 26th, 1904.

APPOINTMENTS OPEN.

MARTELL SCHOLARSHIP IN NAVAL ARCHITECTURE.

A SCHOLARSHIP of the annual value of £50, and subject to certain conditions, tenable for three years, will be OFFERED for COMPETITION by the Institution of Naval Architects.

Candidates must not be less than 18 or more than 21 years of age on March 1st, 1905, and must at that date have been continuously employed for two years upon naval architecture or marine engineering.

Further particulars may be obtained from the SECRETARY of the Institution of Naval Architects, 5, Adelphi Terrace, London, W.C. (envelopes to be marked "Martell Scholarship").

Applications must be sent in by February 1st, 1905.

BURNHAM URBAN DISTRICT COUNCIL (SOMERSET).

APPOINTMENT OF DISTRICT SURVEYOR, INSPECTOR OF NUISANCES, AND WATERWORKS MANAGER.

The above Council will, at a meeting to be held on Monday, the 16th day of January, 1905, be prepared to consider APPLICATIONS from PERSONS DESIROUS of FILLING the above OFFICES.

The salaries will be as follows, viz.: District Surveyor, £50 per annum; Waterworks Manager, £10 per annum; Inspector of Nuisances, £60 per annum.

The person appointed to hold the three offices.

The appointment of Inspector of Nuisances will be subject to confirmation by the Local Government Board.

The duties of the offices will be those prescribed by the Public Health Acts, the regulations of the Local Government Board, and the By-laws now or hereafter to be in force and adopted by the Urban Council, and will commence at Lady Day next.

The person appointed will be required to reside in the district, and to give the whole of his time to his duties.

Sealed applications in candidate's own handwriting, stating age and present and previous occupations, with recent testimonials as to character and competency, not more than three in number, must be sent to me on or before Saturday, the 14th day January next.

The Council do not bind themselves to appoint any applicant.

Candidates who may be selected to attend the Council on the day of appointment will receive due notice.

Canvassing will disqualify a candidate.

By order,
D. S. WATSON,
Clerk to the Council.

THE VICTORIA UNIVERSITY OF MANCHESTER.

The Council desires to proceed to the APPOINTMENT of a PROFESSOR of ENGINEERING.

The Professor will be responsible for the organisation of the Engineering Department, and will have the direction of the Engineering Laboratory.

He may take a consulting practice under specified conditions.

His stipend will be composed of a fixed salary and a share of the fees, and the Council guarantee that the total income will not be less than £1,000 per annum during the first three years.

A detailed statement of the conditions of appointment may be obtained from the Registrar.

Applications, with references and such testimonials (not exceeding three in number) as the candidate may desire, should be sent on or before February 15th to the Registrar.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23 and 25.*

In order to assure fair treatment to advertisers, each firm is indexed under its Leading Specialty ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.
Rossendale Belting Co., Ltd., 10, West Mosley Street, Manchester.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
John Thompson, Wolverhampton.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.
Hartley & Sugden, Ltd., Halifax.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

Cables.
St. Helen's Cable Co., Ltd., Warrington, Lancashire.

Case-Hardening Compounds.
Hy. Miller & Co., Milligarth Works, Leeds.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, 8, New Street Square, E.C.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.
H. J. H. King & Co., Nailsworth, Gloucestershire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Condensed Water Purifiers.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.

Continental Railway Arrangements.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Brown Hoisting Machinery Co., 39, Victoria Street, London, S.W.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Economisers.
E. Green & Son, Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Bruce Peebles & Co., Ltd., Edinburgh.
Brush Electrical Engineering Co., Ltd., Victoria Works Belvedere Road, London, S.E.
Crompton & Co., Ltd., Arc Works, Chelmsford.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Premier Electrolyte Co., 26, Spital Square, London, E.
Simplex Steel Conduit Co., Ltd., 20, Bucklersbury, London, E.C.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engines (Electric Lighting).
J. & H. McLaren, Midland Engine Works, Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Momentum Engine, 19, 19a, Imperial Buildings, Ludgate Circus, London, E.C.
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.
E. J. & J. Pearson, Ltd., Stourbridge.

Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd. Coventry

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.

Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.
Power-Gas Corporation, Ltd., 39, Victoria Street, London, S.W.

Gauges.
Klinger, Richard & Co., 66, Fenchurch Street, London, E.C.

Gears.
Hamilton & Co., J. B., 145, Cannon Street, E.C

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
William Asquith, Ltd., Highroad Well Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London S.E.

Indicators.
Dobbie McInnes, Ltd., 41 & 42, Clyde Place, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham
Farnley Iron Co., Ltd., Leeds, England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
Hadfield's Steel Foundry Co., Ltd., Sheffield.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co., Derby.
Purdon, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W
Woodhouse & Rixson, Sheffield.

Ironwork (Constructional).
F. A. Keep, Juson & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juson & Co., Barn Street, Birmingham.

Jointing Materials.
Richard Klinger & Co., 66, Fenchurch Street, London, E.C.

Lathes.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax
Northern Engineering Co. (1906 Ltd., King Cross, near Halifax.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry, Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Hy. Berry & Co., Ltd., Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Britannia Engineering Co., Ltd., Colchester, England.
C. W. Burton Griffiths and Co., 1, 2, & 3, Ludgate Square, Ludgate Hill, London, E.C.
Chas. Churchill & Co., Ltd., 9-15, Leonard Street, London, E.C.
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
Wm. Ryder, Ltd., Bolton, Lancs.
G. F. Smith, Ltd., South Parade, Halifax.
John Stirk & Sons, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co., 23, College Hill, London, E.C.
Whitman & Barnes Manufacturing Co., 149, Queen Victoria Street, London, E.C.
Charles Winn & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Metals.
Delta Metal Co., Ltd., 110, Cannon Street, London, E.C.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.

Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Humbolt Engineering Co., Kalk, near Cologne, Germany.

Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Partridge & Cooper, Ltd., 191-192 Fleet Street, London, E.C.
Rockwell-Wabash Co. Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Stolzenberg (Patent) File Co., 50, Bishopsgate Street Without, London, E.C.
Titan Binder Co., 31, Queen Victoria Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

Oils, &c.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United Kingdom Self-Adjusting Anti-Friction Metallic Packing Syndicate, 14, Cook Street, Liverpool.
United States Metallic Packing Co., Ltd., Bradford.
J. Bennett von der Heyde, 8, Brown Street, Manchester.

Paint (Metallic).
Metallic Paint Co., Ltd., Cardiff.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C

Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

Buyers' Directory—(*Continued*).

Photo Copying Frames.

J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W.

Photographers.

Booker & Sullivan, 67 and 69, Chancery London, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Photographic Apparatus.

Marion & Co., Ltd., 22, 23, Soho Square, London, W.

Pinch Bars.

Samson & Co., Garforth, near Leeds.
Stone & Co., J. B., 135, Finsbury Pavement, London, E.C.

Pistons.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Porcelain.

Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.

Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pulleys.

H. J. H. King & Co., Nailsworth, Glos.

Pumps and Pumping Machinery.

Blake & Knowles Steam Pump Works, Ltd., 153, Queen Victoria Street, London, E.C.
Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
I. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.

William Asquith, Ltd., Highroad Well Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.

Rails.

Wm. Firth, Ltd., Leeds.

Railway Wagons.

Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent.

Riveted Work.

F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roof Glazing.

Mellowes & Co., Sheffield.

Roofs.

D. Anderson & Son, Ltd., Lagan Felt Works Belfast.
Alex. Findlay & Co., Ltd., Motherwell, N.B.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

Ropeways (Aerial).

Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.

Cambridge Scientific Instrument Co., Ltd. Cambridge.

Stampings.

Thos. Smith's Stamping Works, Ltd., Coventry.
Thomas Smith & Sons of Saltley, Ltd., Birmingham.

Stamps (Rubber).

Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner, Birmingham.

Stamps (Metal).

Edward Pryor & Son, 68, West Street, Sheffield.

Steam Traps.

British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.

Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.

Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Stokers.

Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

Stone Breakers.

S. Pegg & Son, Alexander Street, Leicester.

Superheaters.

A. Bolton & Co., 40, Deansgate, Manchester.

Time Recorders.

Howard Bros., 10, St. George's Crescent, Liverpool, and 100c, Queen Victoria Street, London, E.C.
International Time Recording Co., 171, Queen Victoria Street, London, E.C.

Tubes.

Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.

G. Gilkes & Co., Ltd., Kendal.
Greenwood & Batley, Albion Works, Leeds.
S. Howes, 64, Mark Lane, London, E.C.

Typewriters.

Elliott-Fisher Co., 85, Gracechurch Street, London, E.C.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

Valves.

Alley & MacLellan, Ltd., Glasgow.
Holmes & Co., W. C., Huddersfield.
Scotch and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.

Ventilating Appliances.

Matthews & Yates, Ltd., Swinton, Manchester.

Wagons—Steam.

Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

Water Softeners.

Lassen & Hjort, 52, Queen Victoria Street London, E.C.

Weighing Apparatus.

W. T. Avery & Co., Soho Foundry, Birmingham, England.
Samuel Denison & Son, Hunslet Moor, near Leeds.
Graham, Morton & Co., Ltd., Leeds.

Wells Light.

A. C. Wells & Co., 100A Midland Road, St. Pancras, London, N.W.

Wind and Water Supply Machinery

Eric S. A. Smith, Bridlington.

Wire Working Machinery.

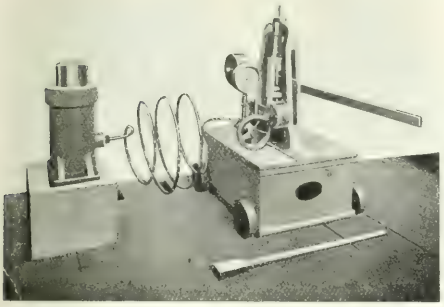
Ed. Brand, 35, Shakespeare Street, Manchester.

"Woodite."

"Woodite" Company, Mitcham, Surrey.

PAGE'S WEEKLY — Machine Tools

HYDRAULIC TOOLS.



BOILER FLUE APPARATUS.

This illustration shows an apparatus for pushing up boiler flues. The cylinder and ram can be got into a flue of 24 in. diameter, and is capable of dealing with plates up to $\frac{1}{4}$ in. of thickness cold.

Prices and Particulars on Application.

RICE & CO.

(Leeds), Ltd.,

ELLAND RD., LEEDS.

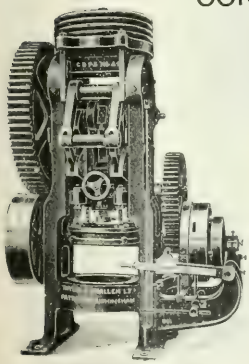
Telegraphic Address: "PRESS, LEEDS."
A.B.C. Code, 4th Edition, used.
National Telephone: 2362.

TAYLOR & CHALLEN, Ld., Engineers,

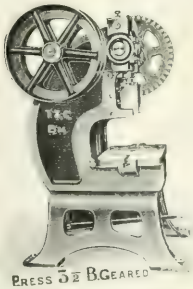
MAKERS OF PRESSES and Machinery for Sheet Metal Work.

CONSTITUTION HILL,

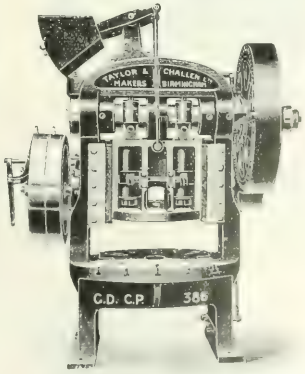
BIRMINGHAM.



Drawing Presses for Seamless Holloware, etc.



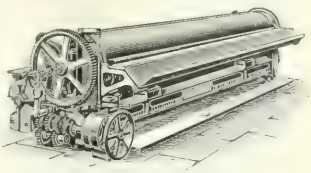
Type B Presses for Cutting-Out, etc.

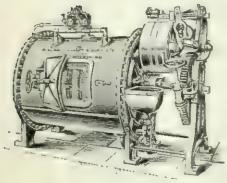


Double Crank Presses for Large Blanks, etc.

PAGE'S WEEKLY — Miscellaneous

Laundry Machinery AND COOKING APPARATUS.





W. Summerscales & Sons, Ltd.

CATALOGUE ON APPLICATION

Pœnix Foundry, KEIGHLEY, ENGLAND.

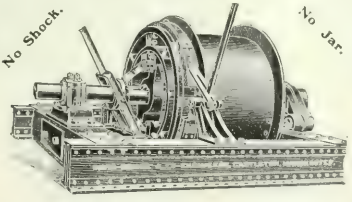
HEYWOOD & BRIDGE'S PATENT FRICTION CLUTCH and SHAFT COUPLING.

Prevents Accidents.

WE MAKE CLUTCHES, SHAFTING, GEARING and HAULING INSTALLATIONS *A SPECIALTY.*

Sixty Page Work—Free.

DON'T MISS THIS.



Hauling Made Reliable.

Patentees and Sole Makers:

DAVID BRIDGE & CO.,

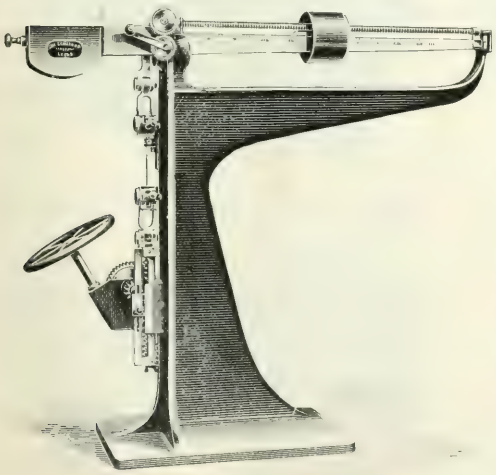
Castleton Iron Works,

ROCHDALE, LANCS.

London Office:

35, Queen Victoria Street, E.C.

Denison's SINGLE LEVER Wire Tester.



This apparatus is arranged for ascertaining the tensile strength of small wire, and is very accurate.

NO LOOSE WEIGHTS.
ACCURATE EXTENSION GAUGE.

Capacity	1,000 lbs. avoir.	(1)
,,	1,250 ,, ,,	(2)
,,	1,500 ,, ,,	(3)

The 'poise weight carries a vernier to show single pounds.

RAPID IN USE.

PATTERN B.

SAML. DENISON & SON, LTD.,

Hunslet Moor,

Telegrams: "WEIGH, LEEDS." Near LEEDS.

PAGE'S WEEKLY — Machine Tools, &c.

PAGE'S WEEKLY — Miscellaneous

What a Noise

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Index to Advertisers.

Advertisements not appearing this week will be found by reference to the preceding or following issues, with the exception of those appearing monthly.

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Miscellaneous

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

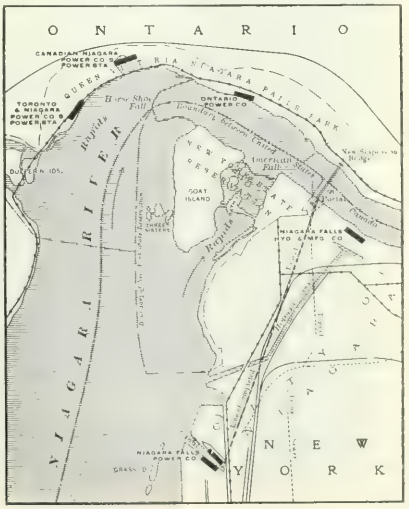
VOL. VI. LONDON, FRIDAY, JANUARY 6, 1905. No. 17.

The Offices of "Page's Weekly," Wednesday, Midnight.

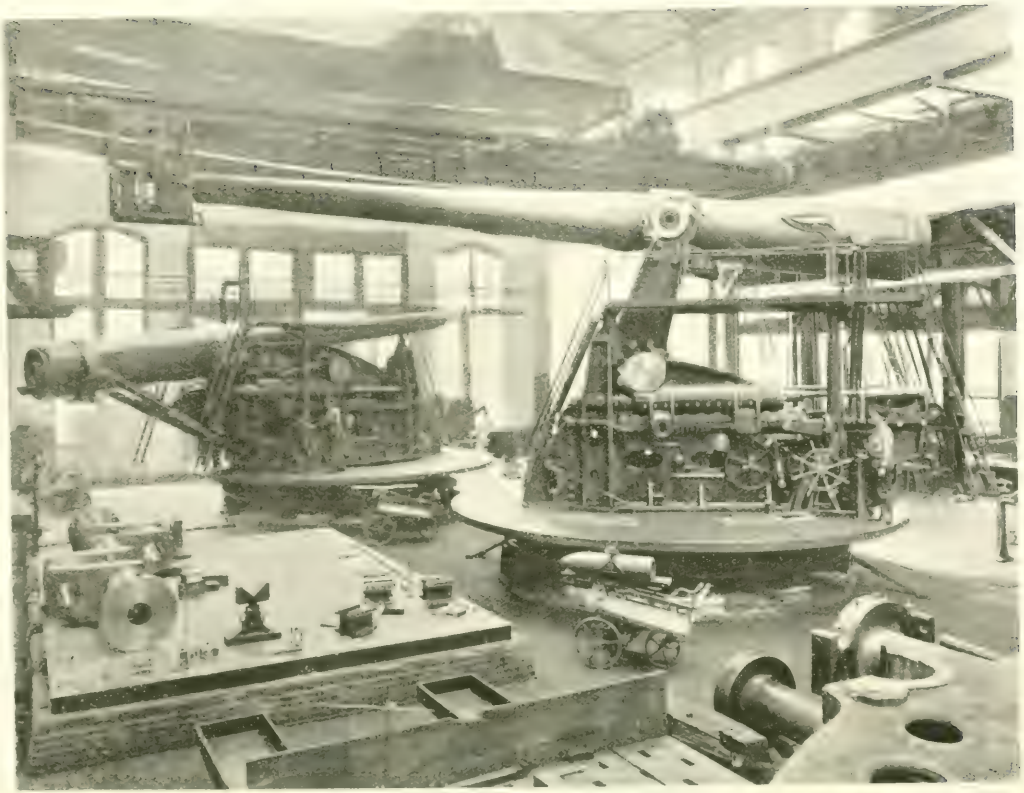
IN previous notes I have commented upon the heat-value of a pound of coal when burnt to the fullest advantage. A few practical hints as to the best means of accomplishing this, follow in natural sequence. But, first of all, I have to thank a correspondent for kindly drawing attention to an obvious omission of mine, for which I cannot even plead the excuse that it was Christmas-time. On page 903 I neglected to specify that the work done in raising 33,000 pounds through one foot, or in the heating of one pound of water through 42·7 degrees Fahrenheit of temperature, in order to equal one horse-power, must be performed in *one minute*, the time being, of course, an essential element in a statement of this kind.

Now, as to the best type of boiler for the economical production of steam. It may pretty well be taken for granted that all surviving well-known types of boilers are capable each in its own way, and for its own purpose, of effective steam-raising if properly handled. Of these the principal in general use are the Lancashire or double-flued cylindrical boiler; the Cornish or single-flued boiler; the water-tube boiler, in various forms; the loco-type boiler, and the internally-fired, return-tube boiler. The smaller kinds of vertical boiler, and small boilers of any kind, as a rule, are installed with other objects than fuel economy, and call for no notice here. Externally-fired cylindrical boilers of all kinds are also out of the running on account of the inevitable deposit of scale on the bottom of the boiler, just where it is exposed to the greatest heat.

The points to be borne in mind in regard to the effective combustion of fuel — proper



MAP OF NIAGARA FALLS, SHOWING LOCATION OF THE VARIOUS POWER STATIONS.



ONE OF SEVEN 12-IN. BREECH-LOADING RIFLES AND DISAPPEARING GUN CARRIAGE BY THE MIDVALE STEEL COMPANY, PHILADELPHIA, PA.

PAGE'S WEEKLY

AN ILLUSTRATED TECHNICAL JOURNAL,

dealing with the

ENGINEERING, ELECTRICAL, MINING, IRON & STEEL, AND

SHIPBUILDING INDUSTRIES

VOLUME VI.

JANUARY, 1905 - JUNE, 1905

CLUN HOUSE, SURREY STREET, STRAND, LONDON, W.C.

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management of the fire being assumed—are, the furnace should be spacious in proportion to the firegrate area, height above grate being an important advantage. Thus, a long grate in a circular flue of small diameter is not desirable. Actual combustion of the generated gases can only be secured by having the heating surfaces (which, so far as the fire is concerned, are cooling surfaces) at a sufficient distance from the fire to avoid extinguishing the flame and chilling down the gases by premature contact with the sides or top of the furnace. Unconsumed gases have a tendency to remain in contact with the plates, and thus, besides representing an actual loss in themselves, effectively cut off the radiated heat of the burning fuel, owing to their non-conducting properties.

Theory and successful practice unite in proclaiming that a high and continuously maintained furnace temperature is essential to proper combustion. No one who has enjoyed the opportunity of watching the firing upon an express locomotive engine during a long run can have failed to notice the extraordinary efficiency of pure radiant heat. For many miles, before the conclusion of the run, the stoker has ceased to ply the furnace with coals. The fire, urged by the tremendous blast, becomes a glowing white-hot mass, and burns down thinner and thinner, the engine, meanwhile, steaming with the utmost freedom. Mile after mile this goes on, until the lights of the terminal station are in sight, and the engine brings up its heavy train with barely as much incandescent fuel in the fire-box as suffices to cover the bars. Under these conditions evidently the furnace temperature is at its highest, and that of the chimney at its lowest; hence the ideal state of working through the maximum range of temperature is approached—for a time.

The nearest permanent approach to this would be the burning of the fuel in a separate furnace or combustion-chambers with walls lined with firebrick, and of sufficient thickness to prevent the sensible loss of heat by external radiation. The glowing walls and roof of the furnace reflect upon the burning fuel its own intense heat and the condition of completed combustion before the heat is abstracted from the gases would be nearly realised. A short flue with two or three baffle-walls to break up and mix the gases would connect the furnace with the boiler; and there should be a rapid draught through and amongst the burning fuel, preferably admitted by a series of small distributed openings. Not one boiler in ten thousand is fitted with this adjunct, but an approximate effect is obtained in many cases by the spacious furnaces used in connection with some water-tube boilers. Locomotive fire-boxes also, when fitted with the fire-brick arch and ventilated fire-door with deflecting plate, and skilfully fired, are efficient furnaces at certain rates of combustion.

In ordinary firing with any class of boiler, the air is for the most part admitted to the furnace through the air-spaces between the fire-bars. The layer of coal should be of uniform thickness and not too thick, and the clinker should not be allowed to obstruct the air-spaces. The fire should be fed at short intervals with correspondingly small quantities of coal, instead of allowing it to burn down low before throwing on a large quantity, thus lowering the furnace temperature by the abstraction of the heat required to gasify the volatile constituents of the new supply. The lowering of the temperature leads to a reduction of the chimney draught at the exact time when the highest temperature and the greatest admission of air are required to effect the combustion of the hydrogen, which, as a consequence, passes away unconsumed, having added nothing to the useful heat of the furnace. A portion of the carbon, also, which at the moment of throwing on fresh coal was floating about in the furnace at a high temperature in search of oxygen to combine with, is cooled down below the temperature necessary to its combustion, and passes wasted away into the

atmosphere either in the form of smoke or combined with the hydrogen as olefiant gas, a valuable compound of six parts by weight of carbon to one of hydrogen. A few minutes' observation of almost any boiler chimney will show by the dense cloud of black smoke emitted at intervals that the intermittent system of firing with the consequences just described is in full force. It is well worth the while of any owner or user of a steam boiler to look carefully into the question, and if the abuse exists to seek the remedy.

The great power scheme of the Toronto and Niagara Power Company, a description of which is completed on page 21, is only, of course, one section of the work involved in harnessing Niagara. The operations which are at present in progress along the Niagara frontier are ably summed up in the Electrical World and Engineer of New York. It is shown that plans are now under way for the development of more than 1,000,000 electrical h.p. with water between the Lake Erie and Lake Ontario levels. Of this total development 146,600 h.p. is represented by the present capacity of hydro-electric plants that are already in operation. Plants now under construction and at various stages of completion have been designed for an ultimate capacity of not less than 553,500 electrical h.p., and plants for which franchises have been secured and real estate purchased, but on which actual construction work has not been started, will, it is said, add not less than 360,000 h.p. to these figures. Of the five plants now in operation, three are in the city of Niagara Falls on the American side of the river, one is in Queen Victoria Park, Niagara Falls, Ont., and another is at the foot of the Niagara escarpment, about three miles from St. Catharines, in the same province.

The two best known plants are those of the Niagara Falls Power Company, on the American bank of the river, which have a combined capacity of 105,000 h.p. Farther down stream, on the same side and also within the city limits, is the station of the Niagara Falls Hydraulic Power and Manufacturing Company, with a capacity of 30,000 h.p. in the electric generators there installed. Just across the river, in the park on the Canadian bank, is the water-driven plant of the International Railway Company, with a generator capacity of 3,600 h.p., including the machine that is just going into position. The station of the Hamilton Cataract Power, Light and Traction Company, near St. Catharines, has a present operating capacity of 8,000 electrical h.p., which brings the total rating of generators at the five stations between the Erie and Ontario Lake levels up to 146,600 h.p., as above noted.

Turning to plants now under construction, the Canadian bank of the river, from a point just below the Horseshoe Falls to more than a mile upstream, is the scene of greatest activity. Along this stretch of park are ranged the partly completed plants of the Ontario Power Company, the Canadian Niagara Power Company, and the Toronto and Niagara Power Company. The plans of these companies in the order named call for ultimate developments of not less than 180,000, 110,000 and 137,500 h.p. respectively. Near these three great plants is that already mentioned of the International Railway Company, where provision has been made for the installation of additional units, aggregating 25,000 h.p. as soon as they are wanted. At the plant above mentioned, near St. Catharines, an extension is under way that will add 40,000 h.p. to its present capacity. Less new work is in progress on the American side of the falls, but the Niagara Falls Hydraulic Power and Manufacturing Company has started excavations for a new station of 50,000 h.p. capacity there. The extensions just mentioned as in progress of construction run up the total to 553,500 h.p. aforementioned. It thus seems that the capacities of eleven generators now operating with water from Lake Erie, plus the capacities of the machines required to complete the plants in process of construction, amount to no less than 700,000 h.p.

THE UNITED STATES CRUISER "COLORADO."

NEWS ITEMS.

The U.S. Cruiser "Colorado"

It is anticipated that the new United States armoured cruiser squadron will not be ready for commission before July, 1905. The squadron will consist of the cruisers *Colorado*, *Maryland*, *Virginia*, and *West Virginia*.

The latest quarterly issue of the American Society Naval Engineers, to hand yesterday, has *inter alia*, an account of the United States armoured cruiser *Colorado*, by Lieut. Commander E. H. Scribner, U.S.N.

The *Colorado* is one of the six vessels of this class authorized by Congress in 1900; she was launched April 25th, 1903. The dock trial was held June 21st, 1904, and the contractor's trial took place on Delaware Breakwater (June 30th to July 3rd, 1904), July 2nd, 1904, over a measured course 1¼ knots long.

The main battery consists of four 8-in. B.L.R.'s, 45 calibres in length; fourteen 6-in. R.F. guns, 50 calibres in length; and eighteen 3-in. R.F. guns, 30 calibres in length. The Secondary Battery has twelve 3-pounders, semi-automatic; four one-pounders, heavy, semi-automatic; four one-pounders, heavy, R.F. guns; two 3-in. field guns; four machine guns, 30 calibre, and six automatic guns, 30 calibre. Two 18-in. submerged torpedo tubes are to be installed.

The protection of the vessel consists of a complete armour belt, 7½ ft. wide, 6 in. thick for a distance of 4 ft. from the top, below which it tapers to 5 in. in thickness at the bottom.

The main engines are four-cylinder, triple-expansion, vertical, inverted-cylinder, direct-acting, placed abreast in watertight compartments and separated by a middle-line bulkhead. The engine design provides for outboard turning screws when going ahead. The order of the cylinders, beginning forward, is high pressure, intermediate pressure, forward low pressure and after low pressure. The H.P. and I.P. cranks are opposite, also the forward and after L.P. cranks, the second pair being at right angles with the first. The sequence of cranks is H.P., forward L.P., I.P., and after L.P. The framing of the engines consists of forged-steel columns trussed by forged-steel stays for the outboard side, and cast-steel housings of inverted Y shape for the inboard side, the latter carrying the crosshead guides of *cast iron*, slipper type, made hollow for cooling water. Each cylinder has one cast-steel inverted Y-frame housing (cast in two halves and bolted together) and two hollow forged-steel columns for its supports. The engines are tied to each other by athwartship braces at H.P. cylinders and after L.P cylinders.

The boilers are thirty-two in number, placed in six watertight compartments, three compartments on each side of the middle line bulkhead.

[illegible] the Cape Verde coast [illegible] bay on the west [illegible] was moderate and weather conditions good. The machinery worked very satisfactorily indeed. There were no hot bearings, and the vessel made all the steam the engines could use under the conditions imposed by the navy department, limiting the steam pressure in the H.P. receiver to 90 lb. per square inch.

The average speed during the entire run, corrected for tide, was 17.3 knots.

Mersey Dock Improvements.

The Mersey Docks and Harbour Board are spending [illegible] in deepening to 37 ft. 6 in. below the old dock sill the greater part of the body of the Queen's Dock with the view of bringing the branch dock into effective use.

German Machinery Exports.

The remarkable development of the German machinery trade [illegible] in recent times is shown by the fact that during the past decade the total value of machinery of all descriptions, including locomotives and other steam engines, as well as sewing machines exported from Germany has increased very nearly threefold. In 1895, the total export amounted to £5,500,000 sterling in value, and in 1904 to £15,000,000. The rate of increase in the exports during the last three years has been more rapid even than during the preceding years. Last year, as these figures show, the total value of the exports increased [illegible] as much as £1,000,000 sterling.

Germany as a Customer.

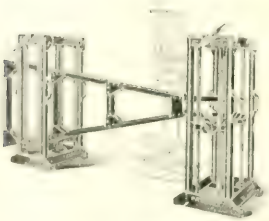
The [illegible] of machinery into Germany during the past [illegible] increased from £1,500,000 in 1895 to [illegible] in 1904, or about 4 per cent. of the exports. The United States [illegible] being followed [illegible] the United Kingdom, Switzerland, Belgium, and Canada. The United States sent to Germany [illegible] steam engines and boilers, locomotives and sewing machines. Agricultural machinery was imported chiefly from the United States, the United Kingdom, and Canada; electrical machinery chiefly from Switzerland. Cotton spinning and weaving machinery has at all times been imported almost exclusively from the United Kingdom. Machine tools from the United States, milling machinery chiefly from Switzerland, brewing and distilling machinery chiefly from the United Kingdom, pumps, [illegible] cutting machinery chiefly from the United States, boiling machinery, ventilators, machinery for cutting metals as well as for working wood were all imported chiefly from the United Kingdom. Machinery for manufacturing wood pulp and paper came from Belgium, steam engines and steam boilers more from the United Kingdom and from Switzerland, locomotive engines and locomobiles chiefly from France and from the United Kingdom, sewing machines from the United Kingdom and from the United States. Interesting facts are those a report by Sir Walter Ward, British Consul-General in Hamburg.

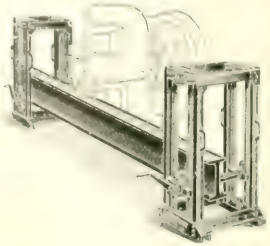
A Portable Conveyor.

In the accompanying illustrations a useful form of portable lifting and conveying apparatus is shown at work. It is a handy piece of appliance for the work shop and erecting shop, but is more particularly designed for handling girders, joists, heavy shafts, [illegible] pipes, etc. The lifting and lowering is effected by means of the handle on the top worm shaft, and the vertical spindle and its jibs, screwed right and left hand, thereby to ensure the load being moved evenly in a parallel manner.

The jibs can be tipped at any point. It rests on a pedestal which is turned by a handle thus giving a [illegible] movement either to the right or left as required.

In the illustrations the apparatus is shown as auxiliary to machine tools. When intended for use as a [illegible] it is fitted to travelling wheels. It is [illegible] [illegible] and [illegible]





[illegible] LIFTING AND CONVEYING APPARATUS.

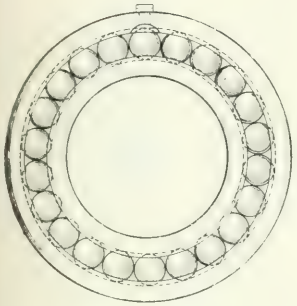


FIG. 1.

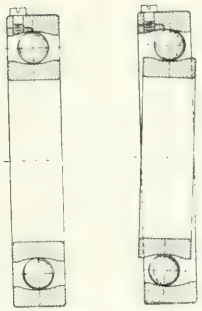


FIG. 2.

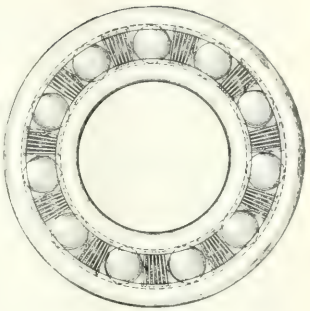


FIG. 3.

Improved Ball Bearings.

The accompanying diagrams illustrate an improved form of ball bearings which the Lahmeyer Electrical Company, Ltd., are fitting with their latest type of small motor for continuous current, in order to bring about a decrease in oil consumption and frictional losses. Hitherto ball bearings of a type as shown in fig. 1 have been used, the space between the outer and inner steel ring being filled with balls so tightly that they touched each other.

Under this arrangement the shaft bends slightly, as shown in fig. 2, the inner ring is no longer running in the same plane as the outer ring, and this causes the balls at the upper and lower parts of the bearings to run on a periphery of smaller radius than in the lateral parts, which means that the balls in the upper and lower parts run slower than the balls in the lateral parts. The balls then knock against each other, and thus lose their circular shape. In the new design, instead of filling the whole space between the inner and outer rings with balls, there is a smaller number, and the space between the balls is filled with springs as shown in fig. 3. If, in consequence of the bend of the shaft, there is a tendency of the outer ring to get out of truth with the inner ring, the variation in the speed of the balls is counterbalanced by the action of the springs, thus avoiding damage to the bearings. The inside of the spring is filled with felt, which forms a rotating lubricating machine.

The new patent ball bearings are manufactured by the Deutschen Waffen and Munitionsfabriken, Berlin, their agents in this country being Messrs. L. Loewe and Co., London.

Mr. William Barclay Parsons.

The report of the death of Mr. William Barclay Parsons, which has appeared in the columns of several contemporaries, is, we are pleased to hear, without foundation. Mr. Parsons is associated with Sir John Wolfe Barry and Sir Benjamin Baker, upon the London Traffic Commission, and was the engineer chiefly responsible for New York's Underground Rapid Transit Railroad. A short account of his career, with portrait, appeared in our issue of the 16th ult.

The Transmission of Wireless Messages.

An important development, which synchronises with the opening of the new year, is the arrangement which has been arrived at between the Post Office and the Marine Companies, by which it has become practicable to despatch from every postal telegraph office in the United Kingdom messages for transmission by the Marconi system from the Marconi Companies' coast stations to ships at sea fitted with the Marconi apparatus. Messages from ship to shore have for some time been passed to their destinations by the overland wires of the Post Office on being handed in by the Marconi officials, but the process of sending messages from an inland telegraph office to a ship at sea via the Marconi shore stations is only now made possible by the new arrangement. Any one desirous of sending a message can obtain at any telegraph office information as to the ships fitted with the Marconi apparatus, the shore stations with which the ship comes into communication, and the hours during which the ship is within range of such shore stations. The whole rate of the transmission will be collected by the Post Office authorities, the land charges being, of course, retained, and the wireless rates handed to the Marconi Companies. The arrangement cannot fail to be of great benefit to commerce, and it should also do much to lighten the burdens of ocean travel.

Engineering Progress in China.

In the course of [illegible] Canton-Hankow [illegible] but the German [illegible] Shantung [illegible] the Northern Chinese Railways, under Mr. C. W. Kinder, M.G. [illegible] The British and Chinese Corporation [illegible] truction during the year of the Shanghai-Nanking Railway, perhaps the most promising line [illegible] the concession granted seven years ago for the Canton-Kowloon Railway, an essential line, one-fifth of which [illegible] British territory. Mining enterprise, with the [illegible] in the world, still awaits railway communication. A [illegible] way to the north of the province [illegible] while in the south of the province the Pekin Syndicate [illegible] ing in Pekin are [illegible]

Sir Oliver Lodge *versus* Fog.

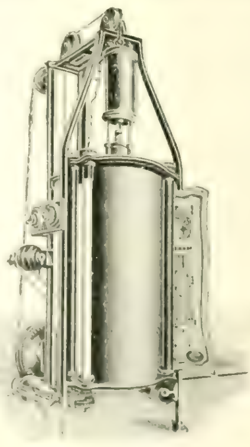
[illegible] attends his experiments, he will have [illegible] combustion [illegible] and while [illegible] applying [illegible] ity is probably prohibitory, [illegible] Birmingham. [illegible]

An Automatic Blue-Printing Machine.

The accompanying illustration represents an automatic blue-printing machine or photo copier for making copies from tracings by electric light. It is designed to overcome the difficulty experienced in making very long prints such as are required for railway plans and [illegible] for bridges, ships and other con[illegible] it impossible to obtain continuity of the lines.

[illegible] nt machine, prints may be ma[illegible] motor.

[illegible] prints, the machine is equally available for short [illegible] or put in. The machine is being put on the market by Mr. [illegible] London, S.W.



[illegible] SHORT PRINTS.

NAVAL NOTES.

WEEKLY NOTES ON NAVAL PROGRESS IN CONSTRUCTION AND ARMAMENT.

(BY OUR NAVAL CORRESPONDENT.)

THE remarkable ease with which the changes enumerated in the new scheme of distribution and mobilisation have been brought into being is another testimony to the foresight and attention to detail which has been so noticeable in the policy of the Board of Admiralty under Lord Selborne. The change in the active fleets, as in the reserve, has proceeded along quite normal lines, and the transference of certain vessels from the Mediterranean to the new Channel Fleet will shortly be accomplished. In the Reserve the steps which have been taken are also quite normal, and the preparation for the commissioning of vessels with nucleus crews during the first four months of 1905 are practically complete. It is intimated that the following ships are to be commissioned in Reserve on dates approximating to those given :—

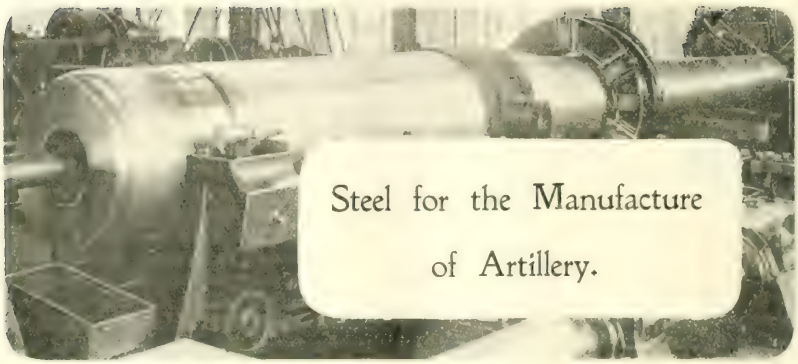
At Portsmouth :—*Cressy* on February 7th, on paying off; *Hindustan* on April 1st, on completion, preparatory to commissioning for active service; *Renown* on April 4th (commissions at Devonport with Portsmouth crew); *Gladiator* on April 4th, after refit. At Devonport :—*Diamond* on January 24th, on completion; *Edgar* on February 1st, after refit; *Nile* on Feburary 28th after refit; *Empress of India* on February 28th, on paying off; *Commonwealth* on February 28th, on completion, preparatory to commissioning for active service; *Cumberland* on April 4th on completion, *Trafalgar* on April 4th, after refit (commissions at Portsmouth with Devonport crew). At Chatham :—*Dryad* on January 17th, on paying off; *Sapphire* on January 17th, on completion; *Royal Oak* on February 7th, on paying off; *Vindictive* on February 14th, after refit; *Bacchante* on February 21st, on paying off; *Talbot* on February 23rd, after refit and *Blenheim* on April 4th, after refit.

The appointments of Admirals to command the squadron in commission in reserve at the Home ports have also been made. Rear Admiral W. H. B. Graham, will be in command at Sheerness, Chatham; Rear Admiral C. G. Robinson, at Devonport; and Rear-Admiral R. L. Groome at Portsmouth. A large number of appointments have also been made to certain ships which are to commission immediately with nucleus crews.

One effect of the further consideration of the scheme has been to lead many people to suppose that the preparation of Rosyth as a naval base was to be discontinued and that the whole project would be abandoned. It hardly required Lord Selborne's letter to convince students of naval affairs that nothing of the sort was in contemplation at the Admiralty. Rosyth will serve a well-defined and very useful purpose both in peace and war, and its selection for the purpose of a naval base cannot fail to popularise the Service in Scotland. The cases of Wei-hai-Wei and Rosyth have nothing in common, and to compare them is as futile and unprofitable as it was in the first instance to compare the new station with Portsmouth. It was never intended to make St. Margaret's Hope more than a secondary base at first, whatever might be the ultimate development of its importance, and any slight modification of the original plans has not touched the fundamental objects of the project.

Bearing on the same subject is the closing of the dockyards at Halifax, Jamaica and Esquimalt, Ascension and Trincomalee. None of these establishments are likely to be required even for serious repairs now that the only vessels cruising in these waters will be the ships of the Particular Service Squadron, which will have their base at home at Devonport. Moreover, it is one of the provisions of the new scheme that vessels shall be made to rely on their own resources and not on the aid of dockyard hands for minor repairs, and this will surely be most insisted on in the training squadron.

The British navy starts the new year under favourable conditions. There is, it is true, some appearance of a delay in the completion of the current shipbuilding programme, but work in the private yards is not very pressing just now, and if the contracts for the armoured cruiser *Orion* and the fourteen new torpedo boat destroyers can be given out, there is every possibility that the builders could get them delivered in record time. Completing, and nearly ready for the pennant, there are three battleships and three protected cruisers, and a large number of old and useless vessels are being cleared away. With the college at Osborne in admirable working order, the college at Dartmouth nearly ready for opening by the Prince of Wales, and the complete abolition of of the old insanitary hulks which formerly served as barracks and training establishments, the prospects for the *personnel* are as satisfactory as well could be; moreover the Navy enters upon the year 1905 knowing that at its head are men of tried and proved ability.



Steel for the Manufacture of Artillery.

By Lieut.-Col. Cubillo (Spanish Royal Artillery).

The writer will be remembered by readers of PAGE'S WEEKLY by reason of the interesting series published a year ago giving Lieut.-Col. Cubillo's views on the reorganization of the Spanish Navy. Lieut.-Col. Cubillo is a well-known officer of the Royal Spanish Artillery, occupying a prominent position under the Spanish Government. He is of opinion that, with the considerable private trade for manufacturing the heavy guns now required in Spain, the article is chiefly intended to show the present state of the iron and steel industry as applied to the manufacture of ordnance for the service in the United States.—Ed.

At the present time the Midvale Steel Company, of Nicetown, Philadelphia, together with the South Bethlehem Company, both in the State of Pennsylvania, are the only two which supply artillery materials to the United States Government.

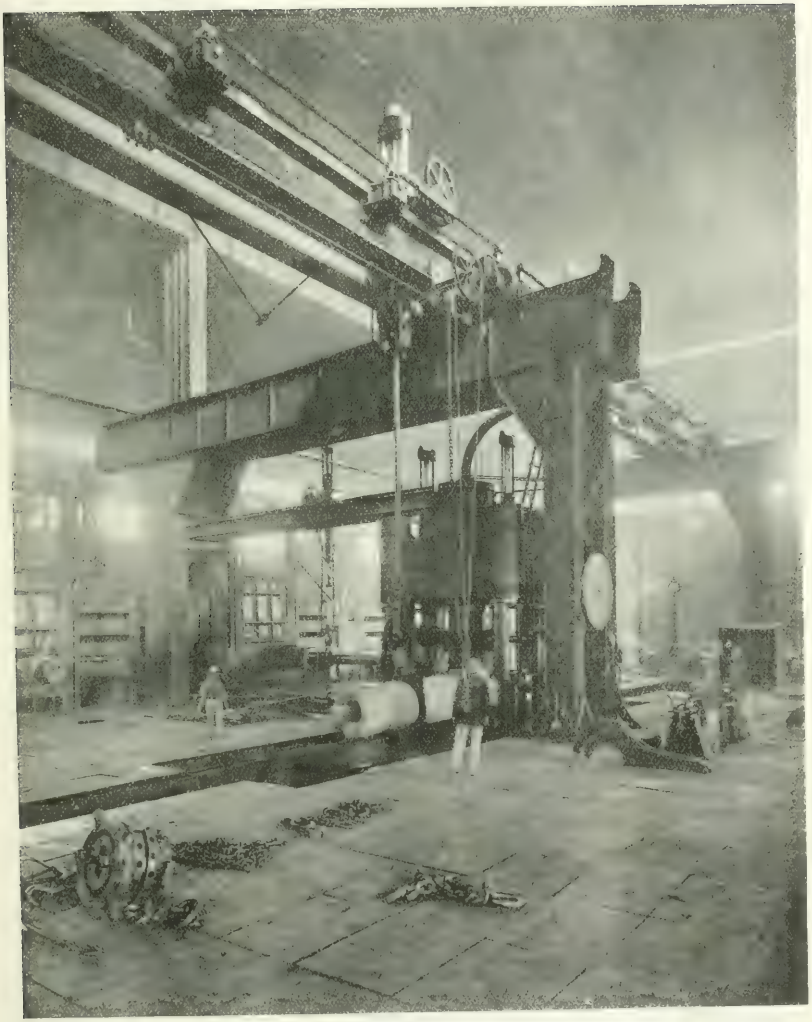
As soon as it was decided that steel should be the only metal employed in the manufacture of United States' artillery, the suggestion was made by a number of people that a class of steel commonly manufactured in that country should be employed, in order to avoid the delay which a thorough training in the making of the class of steel used in Europe would entail. Fortunately these ideas which would have led to the production of a metal unsuitable for artillery use, did not prevail.

At first only a certain tenacity was required in England for gun-tubes; ductility was not taken into consideration. In France, besides tenacity, a certain percentage of ductility was required. In Germany nothing was known, as Krupp refused to publish his tests.

DEFINING CANNON STEEL.

An American artillery officer in defining cannon steel says that it should possess a high tensile limit, good ductility, and strong tenacity to resist the pressure required.

This definition appears somewhat incomplete; for it does not take into account the great heat engendered by the combustion of the powder, nor the action of the gases at great velocities. In reality it is difficult to make a metal equal to all that is required. It is difficult to produce a metal of great elasticity and ductility with carbon steel. Great elasticity requires a hard metal of great tenacity, great ductility is characteristic of soft metals with a low elasticity. As in many other cases this question has been solved by a compromise, a metal between the



PORTION OF THE MIDVALE STEEL COMPANY'S PRESS SHOP, SHOWING ONE OF THE HYDRAULIC PRESSES FORGING A JACKET FOR 12-IN. RIFLE.

two extremes of hardness and softness has been employed, and to-day the composition of cannon steel has become almost identical in all countries.

The following is the result of tests in the U.S.A. :—

	Elastic Limit Kg. per MM.	Tenacity Kg. per MM.	Percentage Per cent.	Contraction Per cent.
Barrels ..	33 ..	62 ..	17 ..	30
Sleeves ..	34 ..	64 ..	16 ..	27
Hoops ..	35·0 ..	64 ..	14 ..	20
Cylindrical Hoops ..	37·6 ..	65 ..	14 ..	20

Cannon metal has always been called a special steel. In reality it is only special in the same sense as steel for rails, boiler plates, or naval construction. The great difficulty in the elaboration of artillery metal is the enormous masses which have to be handled.

SPECIAL DIFFICULTIES.

The series of operations necessary in order to convert the ingots into barrels, sleeves and hoops present great difficulties in the uniform heating of the pieces. In the case of the barrels furnaces of twelve or fourteen metres in height are necessary, and a uniform temperature is far from easy to obtain, even with many injections of gas. All these pieces are extraordinarily sensitive to the action of heat, and when submitted to the high temperature of the hardening furnace. Even when part of the tube is subject to the heat of the sun and the other part is in the shade, a slight twist is occasioned. For this reason when the Minister of War gave Messrs. Niles an order for the construction of several steel howitzers, he insisted that the factory where they were to be made should be of a uniform and constant temperature.

In general the Americans obtain their artillery steel with 0·45 to 0·50 per cent. of carbon. This is what Dudley is attempting to do. As regards the quality of manganese and silica, it is also in about the same proportion, especially manganese, which approximates to about 0·60 per cent. in American and Spanish steel.

INTRODUCTION OF NICKEL.

The American artillery makers do not limit themselves to carbon steel in the manufacture of all classes of guns. The mechanical qualities of nickel were observed. This metal is now employed in all breech screws, and in rapid-fire guns of 5 and 6 calibre. An elastic limit of 50 kg. per square millimetre for breeches, and 46 kg. by square millimetre for rapid-fire guns is required.

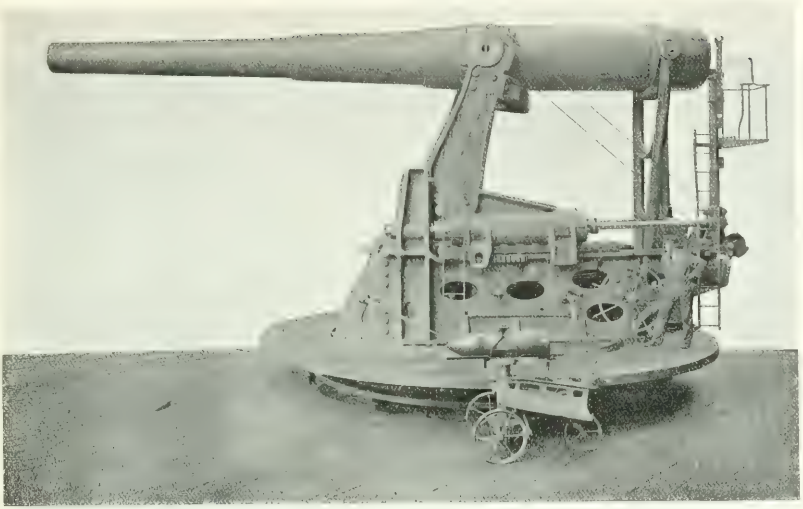
The most commendable quality of nickel steel is its high elastic limit with small quantities of carbon.

After the difficulties of fusing and forging of nickel steel have been overcome there still remains the machine work—no light task, judging by the waste of cutting tools.

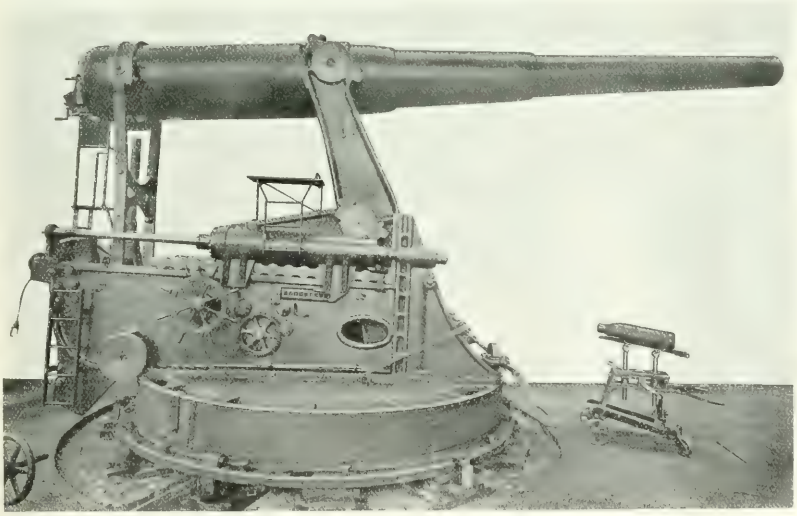
THE MIDVALE FACTORY.

This factory, almost entirely devoted to the manufacture of cannon, steel-castings, and projectiles intended for the army and navy, is situated in Nicetown, one of the suburbs of Philadelphia. Founded in 1866 it first gave its attention to the making of locomotive wheel tyres with crucible steel. Later a rolling mill was installed to produce the wire required for the St. Louis and Brooklyn Suspension Bridges. Subsequently the business was re-organised, Siemens' furnaces being erected and the making of locomotive tyres was again taken up as well as other forged piece for engines and other similar objects. Attention was also paid to steel for rifles, and the greater part of the materials used by the Springfield factory, including those for cannon proceeded from the Midvale Foundry.

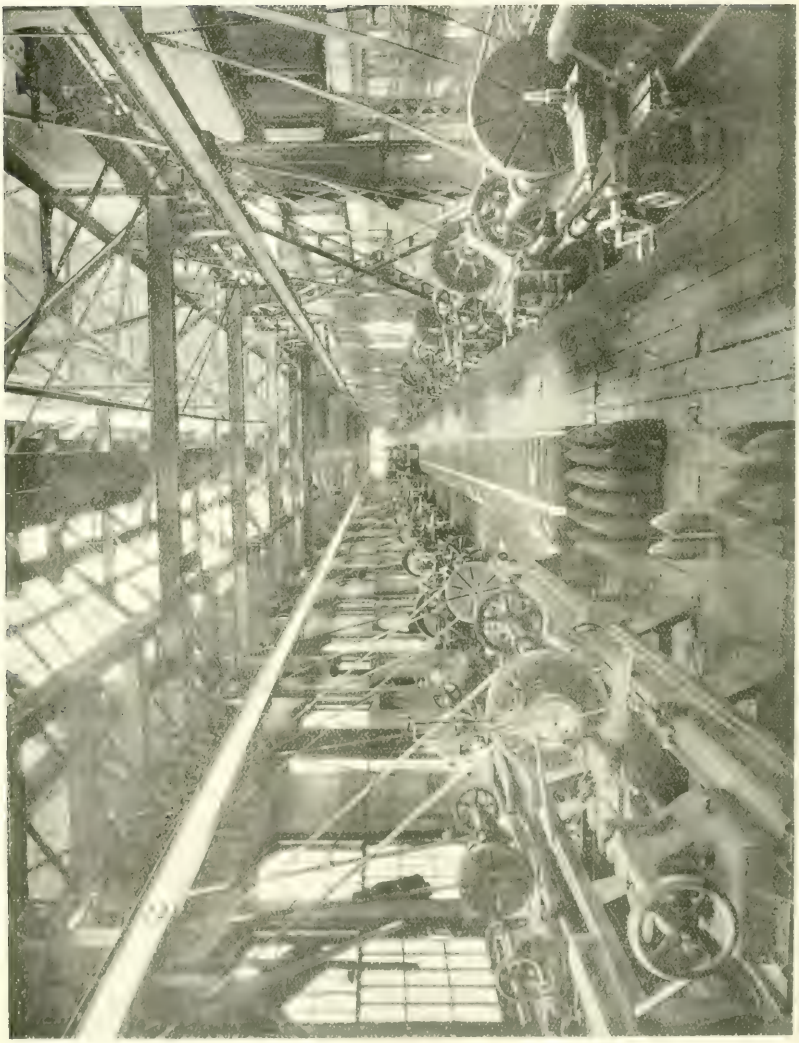
The first attempt to manufacture artillery materials took place in 1877, when several short tubes were provided to line several Parrott guns of 100 and 65 lb. The results, judging by the tests made, were very satisfactory: later on, 1878, they delivered a long barrel of soft metal for the conversion of a 25 centimetre Parrott gun to a rifled one of 22 centimetre.



ONE OF EIGHT 12-IN. BREECH-LOADING RIFLES AND DISAPPEARING GUN CARRIAGES BY THE MIDVALE STEEL COMPANY, PHILADELPHIA, PA.



ONE OF FOUR 10-IN. BREECH-LOADING RIFLES AND DISAPPEARING GUN CARRIAGES BY THE MIDVALE COMPANY.



THE ENGINE DEPARTMENT OF THE MIAMI STEEL COMPANY, PHILADELPHIA, PA.

Eventually, in 1882, they received a contract from the Washington Arsenal for the materials for 15-centimetre guns, one to be hooped with steel wire, the other to be hooped with steel. This gun, the first of 15 centimetre to be constructed entirely of American steel, gave excellent results when tested at Annapolis. It is clear that these materials wrought by a hammer of only nine tons, the most powerful possessed by the Midvale at the time, could not equal the product obtained to-day, but the experiment was a good beginning and persuaded the Company to instal the modern plant necessary for the construction of big guns.

The transformation of the Midvale Company was complete. New Siemens' furnaces of great capacity replaced the old ones, three in number, which, together could only produce ingots of thirty-four tons. A 34-in. Whitworth press replaced the steel hammers.

This press exerting a pressure of 2,500 tons, enabled the Midvale Company to turn out thirty centimetre guns in 1884-1886. The accessories of the press, pumps, cranes, pulleys and shafting, pedestals, anvils, tube expanders, and other forging tools, were similar to those used by Whitworth, now well known at Trubia.

A more powerful press is to be installed at Midvale to facilitate the making of the 30 and 33-centimetre guns. The hardening department, in which oil is used, is well mounted and capable of handling the largest pieces constructed at the present time.

The machine shops are well provided with powerful machines and tools from the best American manufacturers. Midvale does not make use of fluid compression, differing entirely in this respect from the Whitworth process.

They employ excellent first materials in the preparation of the loads for its Siemens' furnaces; the steel destined for the making of guns and armour-piercing projectiles, prepared on an acid bed, necessitates the use of Swedish ingots or other charcoal pig iron of great purity as regards sulphur and phosphorus. The coke pig irons of Europe and America cannot be employed without risk of bad results. A few years ago, when the Campanil ore was worked in the Bilbao, the Trubia factory used the coke pig irons with good results. Conditions have changed, however, pure ores have decreased in the Bilbao district, and even other Spanish charcoal pig irons are not employed, as, although they possess purity in regard to sulphur, they contain as much phosphorus as coke ingots.

At Midvale the steel ingots are smelted in ordinary metallic moulds, octagonal in shape, with concave faces, and others in refractory moulds, an example followed by some other establishments.

The hardening of the various pieces is done in oil, the furnaces being vertical and fired by gas.

At first it was thought it was not so necessary to take much care in the selection of materials for steel castings as in the case of wrought or rolled. It has been found, however, that phosphorus is equally as prejudicial in a casting as in a wrought or rolled piece, and a limit of 0·05 per cent. has been exacted.

The conditions exacted by the American Government regarding steel casting for the army and navy are: the amount of phosphorus must not exceed 0·06 per cent., and as regards calorific treatment, that the pieces should be reheated unless ordered to the contrary.

Midvale also manufactures armour-piercing projectiles of chromo-nickel steel, but their tempering process, of the greatest importance in this speciality, is kept secret. They are not limited to the manufacture of gun materials, but construct disappearing carriages for coast defence, having reached a calibre of 30·5 centimetres.

(*To be continued.*)

LAUNCHES AND TRIAL TRIPS.

COMBINED BUCKET AND PUMP DREDGER.

Messrs. William Simons and Co., Ltd., Renfrew, have just launched, complete with steam up and ready to work, a very powerful dredging vessel of their standard design. The boat is named the *Waitara*, and she has been built to the order of the Agent General for New Zealand. Besides being fitted with a special set of buckets for treating rocky ground the vessel is fitted with a suction pump. The ejectors as well as the suction pipe are made to dredge to a depth of 40 ft. The hopper is arranged in such a manner that the dredgings can be relifted from the hopper and discharged over the side by a special patent arrangement of the builders, and delivered ashore through a long line of floating pipes by land excavators or tube boats moored at the side of the dredger. Ordinary shoot doors are also fitted to the vessel's own hopper so that the material can be lowered at any point required. The machinery consists of two sets of triple-expansion engines and two cylindrical boilers of 160 lb. working pressure.

A STEAMER FOR CUBA.

The new steel screw steamer *Rosario* left Messrs. Workman Clark and Co. Ltd. fitting-out basin at Milewater Wharf, Belfast, last week, for a trial cruise in the Belfast Lough, prior to her departure for Havana. The *Rosario* has been built and engined by Messrs. Workman Clark and Co. Ltd., to the order of Messrs. R. Bustillo and Co. of Havana, and is intended to carry molasses in bulk between ports on the Cuban coast and the States. The propelling machinery which has been constructed by the builders at their engine works consists of a set of triple-expansion engines with all necessary auxiliaries, supplied with steam by two cylindrical multitubular boilers.

THE HUMBER.

Earles Shipbuilding and Engineering Co. Ltd., of Hull, launched on December 29th the large motor-driven steel steam trawler built to the order of Messrs. Messrs. and Lilly Grimsby, for the Fleetwood Steam Fishing Company Ltd. Her dimensions are [illegible] and she will be fitted with triple-expansion engines having [illegible] cylinders and steam supplied by one [illegible] boiler.

THE CLYDE.

There was launched on the 21st ult. from the yard of Messrs. Murdoch and Murray, Port Glasgow, a steel awning decked twin-screw steamer for cargo and passenger service on the River Amazon. On leaving the ways the vessel was named *Rosa de Campos*, and was taken in tow to James Watt Dock, Greenock, where she will be fitted by Messrs. J. G. Kincaid and Co., with compound engines. This is the fourth steamer built by this firm this year for the Amazon.

WEST HARTLEPOOL.

On the 22nd ult. Messrs. William Gray and Co., Ltd. launched the steel screw steamer *Frisco* for Messrs. A. N. Hansen and Co., Copenhagen. She will take the highest class in Lloyd's and Norske Veritas, and is of the following dimensions, length overall 350 ft. 0 in., breadth 50 ft., depth 28 ft. 4½ in., with long bridge, poop and topgallant forecastle. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 26 in., 42 in. and 70 in. diameter, with a piston stroke of 45 in., and two large steel boilers for a working pressure of 160 lb. per square inch.

SELBY.

There was launched from the shipyard of Messrs. Cochrane and Sons, shipbuilders, Selby, on Saturday, the 24th ult. a handsomely modelled steel screw trawler, the principal dimensions being 126 ft. by 22 ft. by 13 ft. The vessel has been built to the order of Mr. H. P. Verschagh, of Ostend, Belgium, and will be fitted with powerful triple-expansion engines by Messrs. Charles D. Holmes and Co., of Hull. She is fitted with all the latest improvements for this class of vessel.

Dockyard Coal-Handling Plant.

Graham, Morton and Co., Ltd., of Leeds, have obtained the contract for the supply, delivery, and erection at the electrical generating station at His Majesty's Dockyard, Devonport, of a complete coal-handling plant including coal bunkers, stanchions, girders, flue, and coal measuring and weighing apparatus and all accessories. All materials used are to be of British manufacture throughout, of the best of their respective kinds and workmanship.

PRACTICAL NOTES ON DRILLING HOLES.

By Valentine Ryan.

THE disadvantages under which a drilling machine performs the work allotted to it, as compared to the other machine tools, are often overlooked. Usually, the latter are machining on "the working parts" of the plants they deal with; these parts are machined on all sides, so their ultimate shape is quite independent of the character of the casting. In these a certain amount of surplus material was provided, so as to permit of some flexibility in marking-off and machining the initial surface. The surface thus obtained is available as a groundwork for all subsequent marking-off and machining; when chosen with discretion it leaves little difficulty for obtaining the other dimensions of the casting to the required degree of accuracy. Thus, unless the casting be an awkward one, there is little excuse for being at fault in obtaining the initial surface, and once this is available, the remainder of the work is greatly facilitated. Very often the drilling of a hole is analogous to performing the second stages of the machining to the same degree of accuracy as before, without the aid of a finished groundwork; this is especially so when holes are required in castings upon which little machining has been done. Working with other machine tools, one can often trace the course the tools will take throughout its travel, the object being to obtain a surface of which one can outline, say, two or three sides; in place of this, how often, when drilling a hole one has to work to a mere centre.

The second surface of a casting must be machined accurately to the first, the third equally so to the first and second, and the fourth to the first, and either the second or third surface. The greater degree of accuracy that is required, the better are the facilities for obtaining it. Thus, a polyhedron is obtained by a series of distinct operations; in practice the error permissible is gradually reduced, and is amply compensated for by the increase in the facilities afforded. In drilling a hole, a cylindrical surface has to be obtained in a single operation, and so is without the aid of any equivalent process for eliminating the error, or any increased control over the casting. In turning, a little surplus material obviates the degree of accuracy in much the same way, but the minute accuracy to which the slide-rest works to the line round which the material revolves, results in the production of accurate work. In this case, also, a cylindrical surface is required, but it is procured by slow degrees, the dimensions required being attained gradually. During the latter stages, a perfectly satisfactory surface to work to is available and the cylindrical surface bears a uniform ratio to that which has to be obtained; or, in other words, the error is first reduced to a uniform one, it then being a comparatively easy matter to deal with the latter. Rimering a hole is analogous to this, but only in exceptional cases do circumstances permit of this being done. Admitted that there are some methods of rectifying errors made in drilling holes, they at the best of times only effect a compromise. Accuracy is really only attainable by the drilling machine performing the work correctly in a single operation; so, compared with the other machine tools, it is handicapped to a greater extent than one has been accustomed to think.

SPECIAL DIFFICULTIES.

To drill a hole is one of the easiest operations a mechanic has to perform, yet it occasionally calls for the exertion of much ingenuity and care. This happens when the hole must occupy a well-defined position throughout its length with one, two, or, perhaps, three, sides

of the material in which it is drilled, especially when the latter affords no satisfactory surface to work to. The most obvious expedient is to work to a standard set of templates, as is adopted to some extent in all works. It is not easy to explain why this cannot be followed to a greater extent than is found possible; there are always some well founded reasons for doing so, not apparent at first sight. Sometimes a [illegible] is discovered that diminishes the difficulties considerably; usually an undue amount of time is wasted before a satisfactory one is arrived at. Some of the precautions adopted and arrangements found convenient when difficulties of this kind are encountered should be [illegible]. Those dealt with in this article may be modified in various ways as suggested by each one's experience, or by the special requirements of the work upon which they are engaged.

A RELIABLE DRILL-GAUGE

A [illegible] use, drilling a few holes now and then when a [illegible]

[illegible]

[illegible] to completely fill the holes, [illegible]

When working with B.A. screws in brass, the drills for tapping one size of hole can be conveniently used as a clearance drill for the next smaller size. So 5 B.A. tapping is just the right size for 7 B.A. clearance; working in iron, the 7 B.A. clearance is a shade too small for 5 B.A. tapping, the iron being more brittle, the tap should only be allowed to remove as little surplus material as possible. Working with iron matters must be cut much finer; brass-workers now and then overlook this point and broken taps are the result.

DRILLING SMALL CASTINGS.

Holes are sometimes required to be drilled and tapped in the centre of [illegible] pieces of metal; the latter are often placed in the chuck of a lathe and the drill fed with the back-centre; the centre on the back of the drill is grooved [illegible] in Fig. 2. Owing to constant

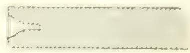


FIG. 2

pressure the centre of the groove will run out; to [illegible] a smaller hole is drilled, say $\frac{3}{16}$ in. deeper; this is sufficient to guide the centre when the groove wears.

Many small castings are required to be drilled [illegible] lathe. A centre as shown in Fig. 3 [illegible] is of great [illegible] work. A pair of washers are provided to facilitate the setting of the centre in line with the drill; in the majority of shops this

FIG. 3.

plan of working between centres in a drilling machine seems never to have suggested itself. It is surprising how easy this simple device will render awkward jobs.

Occasionally it is difficult to drill two holes in the exact relative positions required; such a difficulty may sometimes be overcome by drilling one hole first, plugging it with a piece of brass, and finding the centre of the same; then using this new centre to mark-off the position of the second hole. In fig. 4 is shown a template

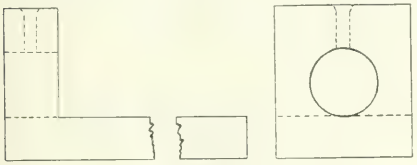


FIG. 4.

in which the bottom of a big hole B is required to be flush with the surface of A; the second hole C being required in the exact centre of B. This is rendered easy by confining one's attention to drilling B in the position required, and marking-off the centre of C as described.

SMALL HOLES IN BRASS STAMPINGS.

Drilling small holes in light brass stampings entails much time and expense; manufacturers avoid this by stamping out as many holes as possible. To ensure good work, a sample stamping is taken, work marked-off, and, perhaps, templates made from it; it will be subsequently found, when the material is assembled and fitted together, that the position of a considerable percentage of the holes in quite inaccurate. The result is that many of the light screws in the equally light stampings have to be screwed hard, and the threads on either not infrequently stripped. It would not be safe to estimate the quantity of material wasted in this way—workshop managers do not object to seeing a few big barrels full of such stampings. Nearly all this waste is due to the sheets of metal out of which the stampings are made being slightly buckled; at the moment the holes are stamped the plate is pressed out, and when free again the metal springs back into its former shape, thus altering the relative position of the holes.

Placing steel centres round the holes in gigs repays in all cases; when a little experience is obtained in doing so, the loss of time involved is small indeed. The gigs should be well tinned in and about the hole, the steel centre placed in position with a few small chips of solder around it; a small blow-pipe flame will quickly melt these, and the whole should be instantly dipped into water. This method has the following advantages:—

1. It does not alter the temper of the steel, as so small an amount of heat is required;

2. It provides the necessary solder with no surplus, thus making a neater job; and

3. The steel centre can be fixed firmly in position, there is no liability of altering the same.

When drilling small holes in round rods in a gig, the drill being small, is flexible, and so is liable to "run out." This may be avoided by making the steel centres $\frac{5}{16}$ to $\frac{7}{18}$ in. high, which provides extra bearing surface, keeps the drill true, and lessens the liability of it being broken.

CASTINGS WITH ONLY ONE SIDE AVAILABLE.

Occasionally castings are met with which have only one side on which work can be done, their shape rendering the other side inaccessible. This difficulty can be overcome by making a hollow gig to hold the casting in a fixed position, and then drilling the holes in it, thus permitting of the only side available being utilised to fix the casting in position, and at the same time, enabling the holes to be drilled in that surface. A typical example of making one side of a casting fulfil a twofold purpose is afforded by the master-chuck shown in fig. 5. This

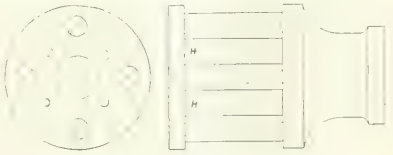


FIG. 5. MASTER CHUCK.

is screwed on to the headstock of a lathe, and is designed to hold a casting on the surface

H H by means of screws in the holes shown; the large holes at the centre of the chuck enables the casting to be turned out. Positive cotton holders for arc lamps, with a neck on the top to hold the washers round the carbon in position are made in this way.

OTHER EXAMPLES.

When pedestals are required to be fixed to bed-plates having oval-shaped holes in the former to afford the radial necessary adjustment; where such holes will not be permitted, the degree of accuracy in the drilling must obviously be great. To secure this accuracy scribers with pointers at the end [illegible] are made in such a way that they will freely revolve in the holes in the pedestals. The latter are set in position by a long scriber fixed in a trial-bar, and the position for the holes in the bed-plate outlined by such a scriber. Edinburgh Booster sets, consisting of four armatures directly coupled together, thus forming one long shaft running in five bearings, can have the position of the pedestals determined by this means with surprisingly accurate results.

To afford the necessary guidance to the drillers it is a common practice to make four centre-punch marks at equal distances on the circumference of circles of the size of hole required. Engineers frequently make the marks of unequal size, which tends rather to deceive the drillers, as after the drill has been at work for a few moments, the driller looks for the remains of the marks. If one of perhaps four are bigger than the remainder, he proceeds to draw the hole in the direction of the former.

Holes are sometimes met with that are required to be slightly bigger at the bottom. This may be effected by drilling the hole with a V-shaped drill, and then grinding the drill out of centre when the depth of the hole is near that required.

To make a presentable job of fitting oil lids on pedestals is not so easy as would appear, jigs or templates cannot be recommended for such work. The only satisfactory plan is to fit the lid on temporarily, leaving some surplus material on the bosses, the lid can be set and holes drilled in what may appear to be the correct position. By finishing the doors afterwards any inaccurary in the drilling can be overcome as far as the appearance of the job is concerned. Which method of working, though not a straight one, is too often overlooked.

ADVANTAGES OF TWIST DRILLS.

Twist or fluted drills work quicker under given conditions than V-shaped ones a fact that is clearly recognised by mechanics, but a satisfactory explanation is not really obtainable. The following reasons have suggested themselves to the writer. A big percentage of the work done in drilling holes is expended in driving the point of the drill by small stages deeper into the material. Owing to the large bearing surface of the twist drill in the holes, this penetrating power is kept concentrated in one spot, and once a sight operator is made the centre of the drill is kept fixed on that point, thus affording the cutting edges an opportunity of attacking fresh material. With a V-shaped drill the point is pushed from side to side by the cutting edges while owing to frequent grinding, the cutting edges of V-shaped drills are usually at different angles to the centre line of the drill consequently one cutting edge will not follow up the work done by the other; with twist drills the tendency is to distribute the work more evenly. As the grooves occupy symmetrical positions round the centre of the drill, so each cutting edge counteracts the errors of the one that preceded it in removing the material. The grooves of twist drills afford a satisfactory clearing path for the material to reach the surface, leaving the cutting edges free to attack fresh material.

125,000 H. P. Electrical Plant of the Toronto and Niagara Power Company.

(*Continued from page 1003.*)

THE large gathering dam will ensure a supply of close on 2,000,000 cubic feet of water per minute, The needs of the station of the Toronto and Niagara Power Company are estimated at 700,000 cubic feet. The overflow will pass over the top of this dam in a cascade, thus adding to the picturesqueness of the Falls.

The water thus gathered will be conveyed downward through steel tubes to the water-wheels located in the bottom of the wheel-pit, and the differences of level provided by the design are such that, after deducting losses from friction, and the velocity of approach and discharge, there will remain an operating head of 143 feet to be used by the turbines. The wheel-pit is provided with masonry lining, the provision that the turbines and all the machinery above them shall rest upon solid rock foundations, instead of artificial supports, as has hitherto been the practice is an element newly adopted for this construction, and the value of which is apparent.

As has been the case elsewhere, the formation of ice during the winter months is one of the serious problems which confront the hydraulic engineer at Niagara Falls. The site which has been selected for the power house is one which is believed to offer less trouble from this cause than any other existing or contemplated plant at the Falls. Moreover, before the water reaches the turbine chamber it will have to pass through two rows of submerged arches and then through a rack, by which means ice and floating debris will be kept clear of the pumps.

The main tunnel will be about 25 ft. in diameter, speaking roughly. At present it is being heavily timbered foot by foot, as the heading is blasted out.

The labourers are mainly Italians and coloured men here and throughout the works, and there are also a number of French-Canadians.

A glimpse of the Falls which few people are privileged to obtain is to be had from the mouth of the tunnel. The curtain of water is about 60 ft. from the base of the rock at this point, the roar of the falling water and the spray which is hurled up in clouds, combining with the wind, give an idea of resistless force which leads the beholder more than ever to wonder how the works he sees around him could have been carried out

In the design of the tunnel, consideration has been given to the fact that the Horseshoe Falls are constantly receding. The lining of the first three hundred feet from the outlet will be put in in rings of 6 ft. long, so that as the Falls recede and the tunnel shortens by the breaking away of the surrounding rock the lining will break away in clean sections and leave a smooth surface at the new end of the tunnel. This will also prevent the cracking of the lining back of the point where the tunnel breaks away. For the rest of the distance, the lining will be of hydraulic pressed brick.

In the crown of the tail-race tunnel there will be constructed a light gallery for observation purposes allowing an inspection of the interior at any time without having to shut off the flow of water

THE POWER HOUSE.

It is asserted that there will be no power-house in the world to compare with that for which the Electrical Developments Company have had plans drawn. By its agreement with the Government, and the Victoria Park Commissioners, the company was bound to erect a building which should not detract from the appearance of the Park. The style of the Italian renaissance has been adopted by Mr. E. J. Lennox in the plans, which the Government and the commissioners have approved. The building will be about 500 ft. long, 70 ft. wide, and 40 ft. high. As it will only be a few yards from the electric car line, and affords an excellent view of the rapids, just above the Falls, there is little doubt but that the power-house will become one of the sights of the Falls.

For the above information our thanks are due to the Electric al Development Company, of Ontario, Ltd., and their Senior Assistant Engineer, Mr. Julian, Thornley.

OUR WEEKLY BIOGRAPHY.

SIR JOHN ISAAC THORNYCROFT, F.R.S., LL.D.

SIR JOHN ISAAC THORNYCROFT, the designer and builder of the first torpedo boat for the British Government, was born February 1st, 1843, in Rome, where his parents, both sculptors, resided for the purpose of studying their art amongst the marbles of the Vatican. Although an artist of considerable distinction, the elder Thornycroft was greatly interested in engineering problems, a characteristic which was also demonstrated at an early age by his eldest son John, whose tendency in this direction was enthusiastically encouraged by his father. He was educated at private schools and when only seventeen years of age he constructed from his own designs the steam launch "Nautilus," the principal dimensions of which were: length, 36 ft.; beam, 5 ft. 10 in. The young engineer's vessel was a complete success and fully justified the general interest it evoked.

In 1864, having attained his majority, Mr. Thornycroft founded the shipbuilding yard at Chiswick which bears his name. Here he began to build small launches and to concentrate his energies on the further development of the principles of construction for which he had already established a reputation.

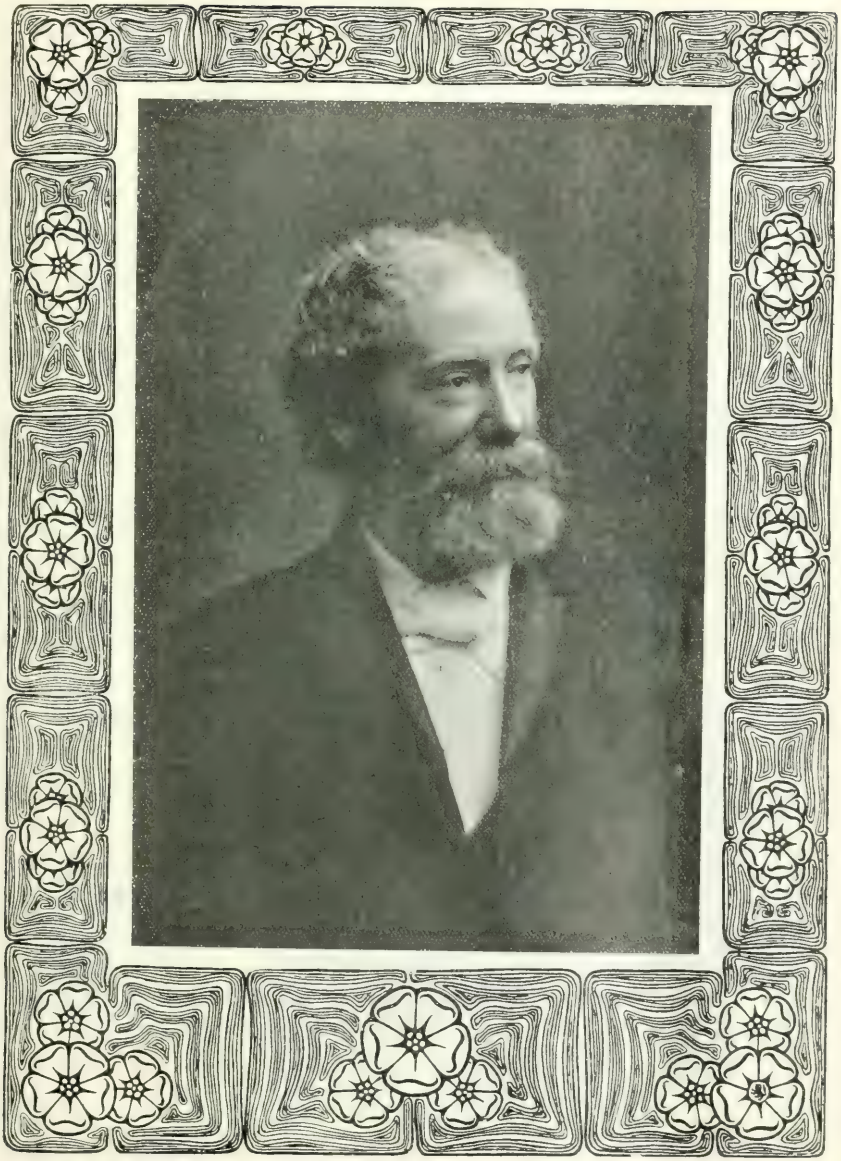
After building a number of vessels he temporarily abandoned construction work in favour of an appointment in the shipbuilding yard of Messrs. Wm. Palmer at Jarrow. Here he gained much valuable experience. He then entered the University of Glasgow and underwent a course of studies in engineering and mathematics. Shortly after the completion of his University career he returned to Chiswick with a well-grounded knowledge of theory combined with practical experience.

His next venture was the launch of the "Miranda," the importance of which may be gathered from the fact that Lord Armstrong and Sir Frederick Bramwell journeyed specially to Chiswick in order to witness its evolutions, and the latter, in 1872, discussed the "Miranda" in a paper contributed to the transactions of the Society of Naval Architects.

Mr. Thornycroft's reputation as an inventor was further enhanced by the completion of the "Gitana," a vessel which had the closed stoke-hold with forced draught, locomotive boilers and engines which united strength and lightness in what was then the most desirable degree.

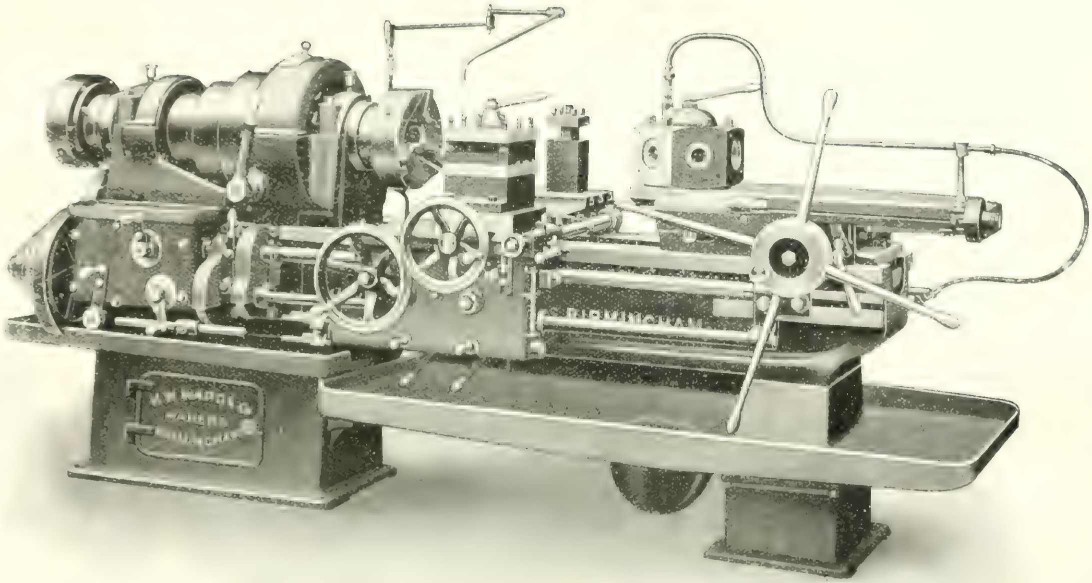
Subsequent years to a great extent were spent in transferring the principles of the "Gitana" to the torpedo boat, giving rise to an industry of which Sir John is the founder. Amongst his inventions may be mentioned the Thornycroft double rudders and the screw turbine for shallow-draught vessels. Sir John is also the inventor of an apparatus for steadying the roll of ships, and he designed and constructed motor steam-wagons shortly before the passing of the Act which legalised their use in this country; later on he designed steam-wagons which in competition gained several gold medals, and in 1902 won the £500 prize offered by the War Office for the best motor-driven vehicle suitable for military purposes. But his fame as an inventor is chiefly associated with the development of the water-tube boiler. Of course, in some measure, the principles of this invention were theoretically already known, but to Sir John Thornycroft belongs the distinction of perfecting the scheme and making the utilisation of the water-tube boiler advantageous. As will be remembered, the boiler was shortly afterwards adopted by the Admiralty on an extensive scale, and it gradually met with universal approval.

Sir John Isaac Thornycroft is the Vice-President of the Institution of Naval Architects; Member of the Council of Mechanical Engineers; Member of the Council of the Institution of Civil Engineers, and a Member of the Committee of the Automobile Club.



Phot. by Elliott and Fry.

SIR JOHN ISAAC THORNYCROFT, F.R.S., LL.D.



INCH CENTRE CAPSTAN LATHE BY MESSRS. H. W. WARD AND CO., OF BIRMINGHAM.

[illegible] by means of four screws or studs [illegible] the turret is turned the right [illegible]

PLAN AND ELEVATION OF NEW CAPSTAN LATHE BY MESSRS. H. W. WARD AND CO., OF BIRMINGHAM.

Total length of counter-shaft, 8ft 6in. Speed of counter-shaft, 80 and 250 revs. per minute.

11-in. Centre Friction Geared Capstan Lathe

By Messrs. H. W. Ward and Co., Birmingham.

We illustrate on pages 24 and 25 an 11-in. centre capstan lathe made by Messrs. H. W. Ward and Co. This machine is particularly adapted for machining steam engine parts, gas engine parts, motor-car details such as pistons, change gears, bevel wheels, gear covers, etc., etc. The large hole through the spindle is $4\frac{3}{8}$ in. diameter, enabling the lathe to be used for making gear blanks, ballraces, etc., up to the size of the hole, from bars, which is of course a much more economical method than making them from forgings.

The headstock carries a hardened steel spindle, which runs in parallel adjustable gun-metal bearings. It is driven by a three-speed cone pulley of large diameter carrying a belt $4\frac{1}{2}$ in. wide. The gearing is of the power 8 to 1, and with the two-speed countershaft which is supplied gives twelve changes of speed to the spindle. The change over from belt to gear drive is accomplished by means of the lever in front of the headstock. This operates a friction clutch, which may be moved over while the lathe is running.

The capstan rest is arranged to move along the bed, and to clamp in any desired position by means of two bolts and keep plates. The top slide is very stiff and extra long, giving a useful traverse.

The total traverse may be used for exceptionally long jobs by throwing the automatic revolve out of gear, and revolving the turret by hand—a very useful feature which is seldom found in the ordinary tool.

The capstan itself is hexagonal in form 10 in. across its flats, and tools may be attached to it either by a round shank, or to its flat faces by means of four tee-slot studs, this offering a very strong method of holding large and heavy tools. Six stops are provided, one for each tool, and the mechanism operating these is geared positively to the turret, so that whichever way the the turret is turned, the right stop for each particular tool is always brought into position. These stops are adjustable, and act as dead stops as well as automatic trips. The feed to the capstan rest is driven from the end of the spindle by a covered train of gear and a three-speed cone pulley, and then through two changes of gear operated by one of the levers under the front of the headstock, thus giving six changes in all. These changes are arranged in a ratio best calculated to meet the different requirements of the work.

The saddle has both automatic sliding, surfacing and screw-cutting motion, and all the feed handles are interlocked, so that when one feed is in action none of the others can be put in without first throwing the other out. The top slide is provided with a square turret at the front and a square tool post at the rear. The square tool post has indexing motion, and may be locked independently at this in any desired position.

Both the tool posts may be removed when desired, and form tools or any other necessary adaptation fixed by means of the tee slots. The feed motion for the saddle is driven from the rear of the spindle by the above-mentioned train of gear, and then through a change gear box operated by three levers, giving eight changes of feed and a reversing motion. All these changes and the reversing motion apply to all the three feeds, viz.: sliding, surfacing and screwcutting. Four automatic and dead stops are provided independently for the sliding and surfacing motions. A pump, tank, and fittings are provided for lubricating the work when using power, and when desired an oil feed through the turret is supplied.

THE UNDERTYPE ENGINE.

By J. C. R. Adams.

(*Continued from page* 969, Vol. V.)

Previous articles on the subject of Portable Engines will be found in the July, August, September, and October Numbers of Page's Magazine, and in the subsequent numbers of Page's Weekly.

ESSRS. DAVEY, PAXMAN AND CO., of Colchester, were very early in the field with their Compound undertype engine, much of the electric light and power supplied to the South Kensington series of Exhibitions, 1883, and onwards, being driven by Messrs. Paxman's engines of this class.

MESSRS. DAVEY, PAXMAN AND CO.'S UNDERTYPE COMPOUND.

Fig. 6 illustrates with sufficient accuracy the design of both the compound and high-pressure automatic classes, the particular engine shown being one of the larger sizes, which from 25 n.h.p. and upwards are made with cast-iron built-up girder beds, below that size being mounted upon a steel channel frame. In general arrangement the engine details are similar to those of the compound portable engines already noticed, and, of course, the same degree of efficiency and economy is obtained from the undertype class.

Horse Power. Nomi	Effective.	Cylinder. Dia	Stroke.	Revs. per Min.
4	7–10	6½	12	135
6	12–15	8½	12	135
8	16–20	7½	12	135
10	20–25	10½	14	120
12	24–30	12	14	120

DOUBLE CYLINDERS.

8	14–20	6½	12	135
10	20–25	7¼	12	135
12	24–30	8¼	12	135
14	28–35	8¾	12	135
16	32–40	9½	12	135
20	40–50	10½	14	120
25	50–62	12	14	120
30	60–75	13	16	135

COMPOUND.

Horse Power Nomi.	Effective (Economical Load).	Cylinder. H.P.	L.P.	Revs. Stroke.	Per Min	Total Weight. Cwt.
8	22	5½	9	14	155	89
10	27	6½	10½	14	155	108
12	33	7	11¼	14	155	128
16	44	8	13	14	155	170
20	55	9	14½	16	135	203
25	68	10	16	18	120	250
30	82	11	17½	18	120	303
35	90	12	19	24	90	376
40	110	12½	20	24	90	404

The working pressure of the compound engine is 140 lb., and the cylinder ratio is about 2·6 to 1. The cranks are not balanced, but both central and outside bearings are provided for the crankshaft.

RUSTON'S COMPOUND UNDERTYPE.

Messrs. Ruston, Proctor and Co., Ltd., of Lincoln, also make a speciality of the undertype engine. Fig. 7 illustrates a very fine example, built for the Indian North Western Railway. The wrought-iron girder frame (optional as against the cast-iron bed) is very strongly attached to, and stiffened by, the portion of the cylinder casting projecting downwards, to the planed sides of which the channel girders are bolted. At the other end the massive cast-iron ashpan performs a similar function. A central bearing is provided for the crankshaft, which is a machined steel forging, but not balanced. In the 12-h.p. sizes and upwards a fourth bearing is supplied outside the flywheel. The crosshead slides are cylindrical, with box-pattern crossheads having adjustable slide blocks, and the connecting rods at the crank end are fitted with marine type

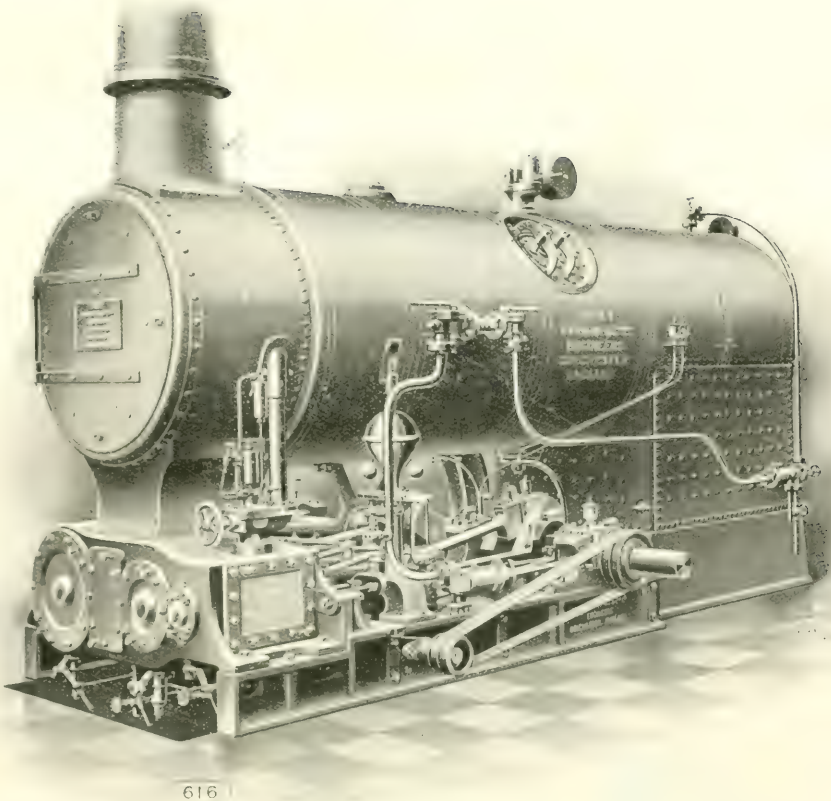


FIG. 6. UNDERTYPE COMPOUND ENGINE BY MESSRS. DAVEY, PAXMAN AND CO., LTD.

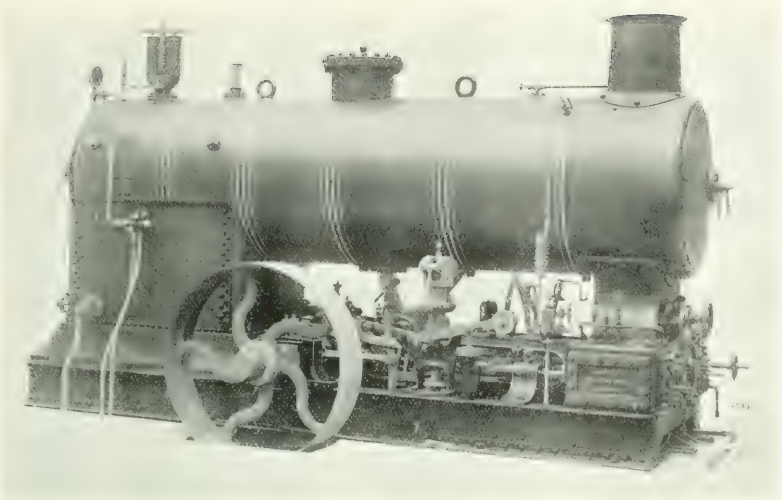


FIG. 7. AN UNDERTYPE ENGINE BUILT BY MESSRS. RUSTON, PROCTOR AND CO., LTD., FOR THE INDIAN NORTH WESTERN RAILWAY.

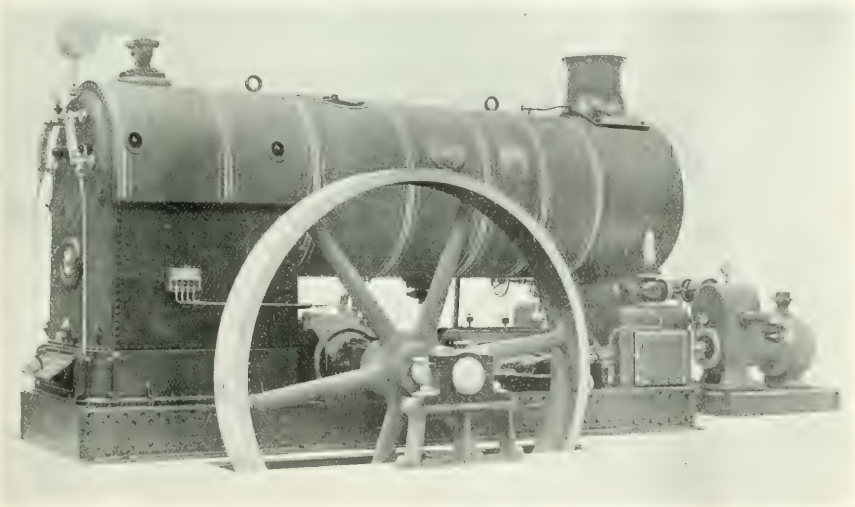


FIG. 8. A SIMILAR ENGINE FITTED WITH CONDENSER.

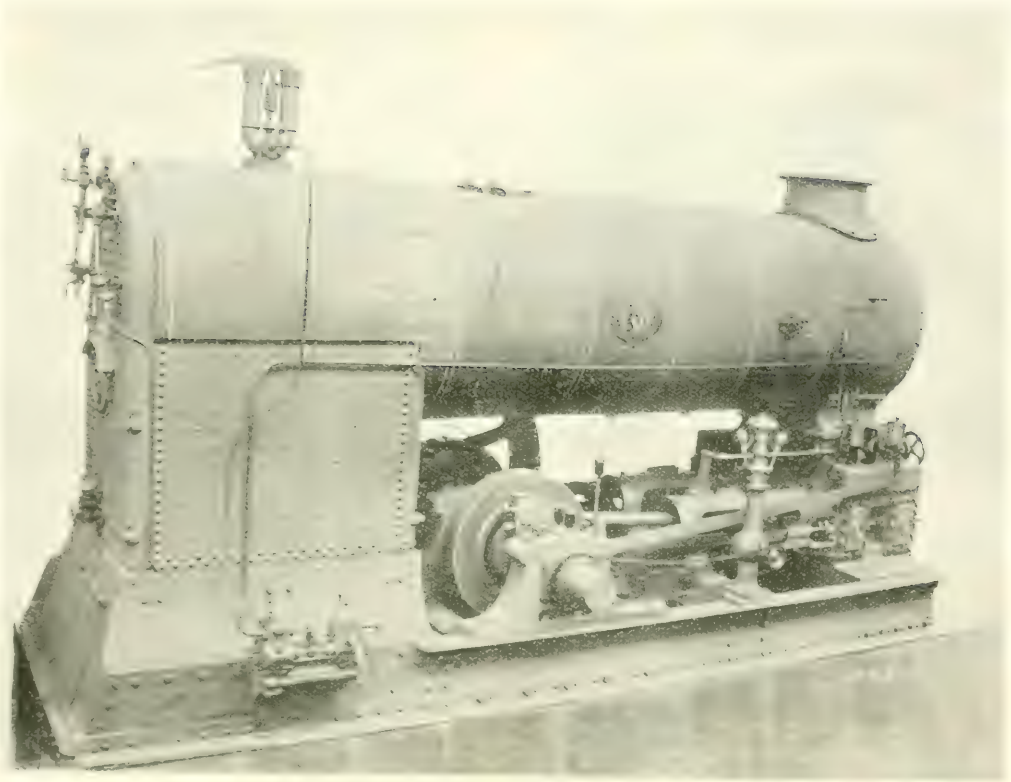


FIG. 10.—ONE OF MESSRS. MAUDSLAY'S TARGET EXPERIMENTAL TRIPLES WITH PROELL EXPANSION GEAR.

brasses. The main bearings are in four parts, with vertical and horizontal adjustments. The automatic expansion gear of the link type, varying the cut-off between the limits of 1 per cent. and 60 per cent., is controlled by a chain-driven governor, fitted with an oil-cylinder or dashpot to ensure steadiness with a sensitive governor. Generally speaking, the equipment of these engines leaves nothing to be desired.

Fig. 8 shows a nearly similar engine, but built to a slightly different specification, and fitted with condenser, the diverting valve hand-wheel for which is seen just under the barrel of the boiler. This engine is fitted with centrifugal oilers to the cranks, and lubricating arrangements for non-stop running, but these, of course, are not part of the regular equipment. Messrs. Ruston manufacture the compound engines in the following sizes, viz. :—

I Horse Power. Nomi.	Effective	Cylinders. H P	L P	Stroke.	Revs., per Min.	Total Weight. Cwt.
6	1 [illegible]	[illegible]	[illegible]	10	[illegible]	[illegible]
8	18–22	[illegible]	[illegible]	12	[illegible]	117
10	24–28	[illegible]	10	12	[illegible]	127
15	30–35	7	12	12	155	150
15	[illegible]	[illegible]	12	15	135	190
20	[illegible]	[illegible]	14	15	135	240
25	25–30	10	15	15	120	280
30	35–40	11	17	15	120	320
35	35–45	12	19	20	105	404
40	110–120	13	[illegible]	24	90	484
50	125–150	14	22½	24	[illegible]	[illegible]

The working pressure is 120 to 140 lbs., and the cylinder ratio is 2½ to 1.

The single and double cylinder high-pressure engines are constructed upon the same lines as the compounds, with steel channel frames, or cast-iron bed plates, at the option of the purchaser. They can be fitted with automatic expansion gear, and with condensers when desired.

DIMENSIONS OF SINGLE AND DOUBLE CYLINDER ENGINES.

Horse Power. Nomi.	Effective.	Cylinder Dia.	Stroke.	Revs per Min.	Total Weight Cwt.
3	8	6"	10	195	40
4	10	7	12	140	64
5	13	8	12	140	70
6	15	8½	12	140	76
7	18	9½	12	140	84
8	21	10	12	140	93
10	28	11	14	130	110
12	34	12	15	125	121

DOUBLE CYLINDERS.

8	20	9½	11	140	96
10	25	7½	12	140	118
12	30	8½	12	140	124
14	35	9	14	125	141
16	44	10	14	125	152
18	54	10½	15	120	177
20	60	11	16	120	195
25	70	12	17	110	272
30	80	13	18	105	312

MESSRS. MARSHALL'S (P. 3) UNDERTYPE, 8 TO 35 H.P.

Messrs. Marshall, Sons, and Co., Ltd., of Gainsborough, make their compound undertype engines up to 35 n.h.p., as fig. 9 (page 32), which is taken from a 30 n.h.p. engine. (The waterheater shown, as well as the non-stop lubricating arrangements are, however, not included in the outfit). The boiler is here illustrated uncovered, to show the riveting, but is, of course, in practice, lagged and finished off, as in fig. 10. Fig. 10 is a view of the larger engines (40 to 60 n.h.p.), which are fitted with Proell expansion gear, in place of the Hartnell, used in the smaller sizes.

MESSRS. MARSHALL'S (P. 4) UNDERTYPE 40 TO 60 H.P.

The leading features of Messrs. Marshall's undertype engines generally are steel-girder frames, cylindrical trunk guides, outside steam chests, balanced cranks with centre bearing, and, in the 16-h.p. sizes and upwards, an additional bearing outside the flywheel. The Hartnell governor is a powerful vertical (as distinguished from Messrs. Fowler's, which runs upon a horizontal axis), spring governor with inverted arms, acting upon a radius-road working in a slot link of the usual type, and thus varying the travel of the expansion valve—a flat slide working upon the back of the main valve.

Dr. Proell's gear, as used in the larger sizes (fig. 10) is of a totally different construction. In this system the steam is admitted to each end of the high-pressure cylinder by a double-seated conical lifting valve, worked thus: From an eccentric on the crank-shaft an inclined flat rod leads to a rocking arm, connected by a short shaft on the top of the steam chest to a double-armed lever at right angles to it. The

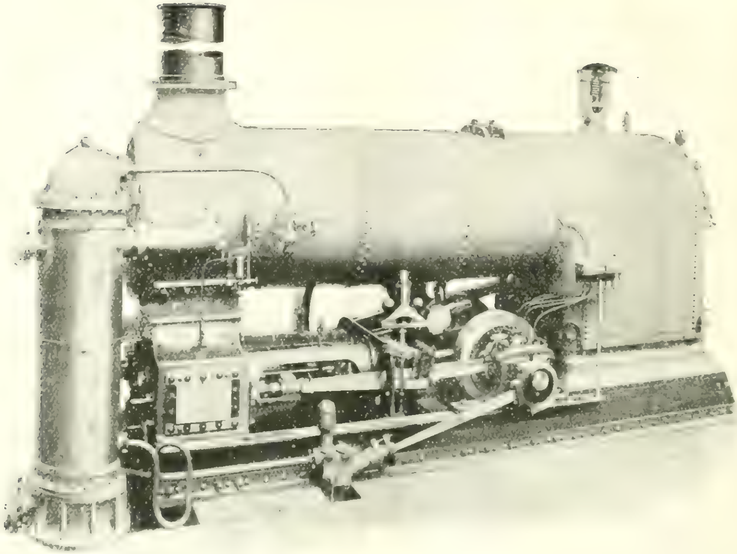


FIG. 9.—100 N.H.P. COMPOUND UNDERTYPE ENGINE BY MESSRS. MARSHALL, SONS AND CO., LTD.

to-and-fro movement of the rocking arm translated into an up-and-down motion of the double-armed lever lifts alternately the steam valves at both ends of the cylinder; and, if it were not for the interference of the governor, would lower each valve on to its seat again as it lifted the other. [illegible] "tripping" or releasing the valves at a point [illegible] which may be anywhere between 0 and [illegible] per cent. of the stroke. The sudden [illegible] when "tripped" [illegible] air-valves in the small vertical cylinders, which form a cushion, and let the valve down quietly upon its seats, yet quickly enough to [illegible] the in-[illegible]. The steam, having done its work in the high-pressure cylinder, is exhausted through another set of ports through slide exhaust valves, worked in the usual manner. [illegible]

floating rings in contact with the steam-chest covers. The low-pressure cylinder is fitted with slide valves upon Meyer's system, in which the virtual length of the expansion valve is altered by right and left-handed screw worked by a hand wheel outside the steam chest, and, consequently, capable of being varied by hand when the engine is running.

Messrs. Marshall's dimensions are as follows: for compound engines at 140 lb. pressure the cylinder ratio averaging 2.56 to 1:—

[illegible]	[illegible]	[illegible]	H.P	[illegible]	[illegible]	Min.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	24	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

(To be continued.)

QUESTIONS OF THE DAY.

III.—The National Encouragement of the British Inventor: How can it be secured? (*Continued from page 970.*)

WHAT CONSTITUTES A PATENTABLE INVENTION.

On the vexed question as to what should and what should not constitute an invention, we have received an interesting letter from Mr. Henry Davey, of Conaways, Ewell, Surrey, from which we have extracted the following :—

Faraday discovered an electric effect by turning a coil of wire in a magnetic field. It required invention to give practical effect to this discovery. The effect itself was new and any mechanism to give practical effect to it must necessarily be new also.

The dividing line between a mere new combination of parts more or less obvious and a true invention is involved in subtlety. Where the new combination produces a scientific result unthinkable to experts generally, then it is distinctly an invention. The inventor has been more far-seeing than the experts.

Inventions are sometimes made without the aid of scientific teaching and are the result of a logical association of common knowledge in the mind of the inventor. Accurate observation of every day things combined with logical methods of thought and a true sense of practical requirements are good without scientific attainment, but are better with it.

The invention of the first steam engine, viz., that of Newcomen, was the result of the logical association of common knowledge in the mind of the inventor, guided by a clear insight into what was practically required.

Watt's improvement on the Newcomen engine was not the result of a scientific discovery, but having observed that steam was condensed by cold water and that the steam entering the Newcomen engine cylinder came into contact with cold water, he set himself the problem of causing the steam to enter the cylinder without coming in contact with the condensing water, and that it should only do so on leaving the cylinder after having done its work. In his own words he succeeded by intense thinking. The logical setting of the problem was the first step, then came the inventive genius in arranging a combination of valves, pipes, cylinders and pistons, all separately known in such a way as to secure the desired result in a practically workable form.

When he succeeded he had made no new discovery, but had made an entirely new combination of mechanism, by means of which a result was obtained not obtained before.

It may be asked, is not a new combination, although not securing any new result, an invention? It is in a restricted sense, and may be an improvement on anything that has been done before, and in that sense, if it is of great commercial or scientific importance, the inventor should be granted protection for his invention.

It is not possible that the Patent Office can determine the value of any proposed patent, but obviously it can help the inventor by giving him a list of patents already granted which appear to be of a similar nature. To refuse an application after that, because of anticipation, would be to pass judgment on patents already granted, and to invest them with a sort of title to validity, a judgment which might, if the refused patent had been granted, be reversed in the Law Courts.

THE CLASSIFICATION AND ANALYSIS OF PATENTS.

The following remarks, anent the subject of sub-division of an invention into several patents and the necessity of a perfect system of classification of patents, appear in the published report of a paper read at the Society of Arts, on December 14th, 1904, by Mr. C. D. Abel.

In the new rules lately issued by the Board of Trade, some general provision has been made in this direction by the statement that "when a specification comprises several distinct matters, they shall not be deemed to constitute one invention by reason only that they are all applicable to or may form parts of an existing machine, apparatus or process," which rule, however, will of course apply generally to all patent applications, and the difficult question will arise as to the proper definition to be put upon the term "one invention."

It would appear that the Comptroller is now going to adopt a definition similar to the German one.

The efficient carrying out of the new system depend probably quite as much upon a proper classification of the inventions as upon the number and quality of the examining staff.

The search as to the novelty of an invention is obviously enormously facilitated, if one has close at hand a complete synopsis of all prior patents in any way relating to the invention in question.

Now the most perfect system of classification in existence is probably that carried out by the United States Patent Office.

In this office, the subjects of invention are divided into 235 classes, and these classes are distributed among 38 examining divisions of the office.

INVENTION THE MAIN-SPRING OF MODERN COMMERCIAL AND INDUSTRIAL ACTIVITY.

Mr. Ashton in the paper referred to paid the following eloquent tribute to the importance of invention.

[illegible] that would be derived therefrom, both by inventors and the public generally, that increased expenditure ought [illegible] any invention that is brought [illegible] honour [illegible] Arkwright, Stephenson, Huntsman, Whitworth, Fairbairn, Bramah, Bessemer, Siemens, and a host of others. How we might many will say. Granted that these men deserve well of the nation, but they had their reward in the ordinary way, made out of their patent rights.

No such view is true, and we but echo many of them when we say it is well known that many noble inventors died in poverty, and that it was not the manufacturers who afterwards adopted their inventions who made money by them. And even in those instances where inventors did reap pecuniary benefit from their inventions, much, in their enthusiastic interest in their inventions, had spent almost their last penny in costly experiments before they arrived at success.

It is well known that the late Sir Henry Bessemer spent nearly the whole of his capital upon his invention prior to [illegible] Again the late Sir William Siemens himself told us that he had spent [illegible] upon his regenerative furnace invention before it was commercially successful.

[illegible]

It [illegible] although naturally recognising their merits [illegible] at any rate in the manner to be anticipated, [illegible] the representatives of their genius and energy. [illegible] Patent Office to protect [illegible] thoroughly complete [illegible]

[illegible] annually [illegible] Patent Office [illegible]

[illegible] Commercial Department [illegible] Chamber of Commerce [illegible] constituting the most representative [illegible]

THE WEEK AMONG THE TECHNICAL SOCIETIES.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

PROPOSED THAMES BARRAGE.

At a meeting of this Society held at Caxton Hall, Westminster, yesterday, a paper on this subject by Mr. James Casey was on the agenda, of which the following is an abstract:

In the author's opinion the scheme offers a solution to the complicated problem of attempting to remove the difficulties and inconveniences attending the navigation of the Thames, owing to the increasing size of steam vessels, and in properly controlling the enormous volume of commerce flowing into and out of the Port.

The tidal portion of the River Thames proper, extending from Gravesend to Teddington is 23 miles in length in a direct course, but owing to the various bends and windings in the upper and middle reaches, is about 46 miles in length, a difference of 13 miles. The width of the river at Gravesend—and here it is proposed the barrage should be—is about 2,400 ft., with a depth at low water of 45 ft. The width of the river at London Bridge is 650 ft. at low water with a depth of 10 ft., and the width of the river at Teddington is 250 ft., with a depth at low water of about 6 ft. The average width of the river between Gravesend and Teddington is about one-third of a mile and the current about four knots, the rise of tide being from 15 ft. to 20 ft. 6 in. at Gravesend, and 17 ft. to 21 ft. at London Bridge. The fall of the river bed from below Teddington is about 1 ft. in the mile and free of any tapel currents.

It will be interesting, says the author, to note the various limits of navigable depths at low water Spring tides from Gravesend to London Bridge, as the river is at present. From Gravesend to Crayfordness the limit is 26 ft. draft at low water Spring tides, and from Crayfordness to Halfway Reach the limit is 25 ft. From Halfway Reach to Surrey Commercial Docks (eastern end) is 15 ft., and to London Bridge under 10 ft. From this 15 ft. limit the Royal Commission proposed dredging the river to a depth of 30 ft. at low water Spring tides down to Gravesend.

THE GRAVESEND LOCKS.

The proposal for constructing a barrage across the river from Gravesend to Tilbury of solid concrete with giant [illegible] piers provides, says the author, for four locks, two of which are to be 1,000 ft. in length and two of 800 ft. and 700 ft. and 500 ft. in width respectively, provided with internal steel gates dividing them into lengths of 500 ft. and 700 ft. in the case of the larger locks and 350 ft. and 500 ft. in the case of the lesser ones. In addition to the outer gates, a number of adjustable steel sluices will also be provided, fitted at the top and bottom of the barrage, and having sufficient area to regulate the flow and necessary scour of the river bottom during ebb tide. In the base of the barrage would be constructed a railway tunnel connecting Kent and Essex with the northern lines which, from a commercial and strategic point of view, would be most valuable. At present all passengers, goods and luggage traffic to and from the Continent has to pass through London, there being no alternative route, but if this railway connection were made, the traffic passing between the Continent and the eastern and midland counties and Scotland would pass directly through without change of carriage, or touching London.

As to the strategic value of the tunnel railway the author points out that it would be about 12 miles from Woolwich Arsenal on the west side, and 7½ miles from Chatham, the great naval dockyard on the east side, thus affording direct and speedy means for the prompt shipment of men and material from these respective depots.

Over the barrage it is proposed to have a roadway for vehicular traffic, and the locks would be worked electrically from a dynamo station. A pilot tower, from which the traffic could be regulated and the locks and movable bridge controlled also forms part of the scheme.

The number of vessels passing in and out of the Port at Gravesend during the year ending June 1903 was 47,514, but the number of small craft, barges, tugs, etc., of 15 tons register and less is stated to be about 34 per week or about 2 in the hour. The four proposed locks working 24 hours per day, would be capable of passing 576 ships and 2,028 barges and small craft in one day. There being a level [illegible] in the 24 hours, and speed

On completion the barrage would hold up a volume

On completion the barrage would hold up a volume

COST OF CONSTRUCTION

through from top to bottom. The French engineers

A DEEP WATER CHANNEL TO THE NORE

derelict for years, the author points out that it would

Thus there is a confluence of tides and

the Barrow Channel, which is both wide and deep, should be utilised. As to the suggestion that a direct straight channel might be made from the Nore to the Alexandra Channel, it could certainly be done, but, as to maintaining it, the author has great doubts, and therefore agrees that the Edinburgh Channel, although some miles longer, is safer, and not so liable to silt up, being protected from the North Sea by the Long Sand.

The volume of the water in the estuary is computed to be at high Spring tides 70,200,000,000 cubic ft., and at low water 30,500,000,000 cubic ft. What is known as the tidal wave arises from the heaping up of the waters, and as the wave approaches the indented coast line its process is stopped, and the water being confined in the narrow channels fills up the estuaries and creeks, and in those cases the tide is higher than the open seas. In shallow water such as the North Sea and Channel, the tides seldom exceed 15 ft. rise, and 15 ft. Spring tide at the Nore.

THE CHARLES RIVER BARRAGE.

The United States Government have for some years past contemplated putting a barrage across the Charles River at Boston, which river is similar in many respects with the Thames, but not so large in volume. After most searching inquiry from an engineering and sanitary point of view, they have now decided to erect the barrage, and commenced operations in June last. A special report has been published and issued, which will be found most interesting and instructive.

The adoption of the Thames barrage, as a whole, deserves, in the opinion of the author, the most careful and serious consideration of the naval and military authorities.

INSTITUTION OF MECHANICAL ENGINEERS.

IMPACT TESTS.

HEAT TREATMENT EXPERIMENTS WITH CHROME VANADIUM STEEL.

AT the last meeting of the Society there was an interesting discussion on the latter paper, reported in last week's issue, and for the illustrations to which we beg to acknowledge our indebtedness to the Institution of Mechanical Engineers, who lent the original photographs from which the blocks were made.

The discussion was a joint discussion on the two papers, "Impact Tests on the Wrought Steels of Commerce," and "Heat Treatment Experiments with Chrome Vanadium Steel."

Captain Sankey, one of the authors of the latter paper, drew attention to the remarkable properties of chrome vanadium steel, and specially drew attention to the fact that when the material was soaked for three hours at 1,200 deg. Cent., it gave considerably better results than when soaked for twelve hours at the same temperature. Also, in the former case, the structure was not nearly so ruined. Various modifications had been made in Professor Arnold's machine for this case, which modified some of the results. One alteration that had been made was that the stroke had been altered from 1½ in. to 2 in. Although these alterations were only small, he pointed out that the results, in order to be comparable with the rest, must be multiplied by two, thus bringing the value to approximately 1,600.

The President, in thanking the authors, said he had received a letter from Sir William Roscoe, who regretted his inability to be present at the meeting, as it was a subject in which he had been interested for fifty years. It would be remembered that Sir William Roscoe was one of the first—if not the first—to separate vanadium.

Dr. Carpenter pointed out that the National Physical Laboratory determined the recalescence point of this steel by a differential method, and made the average 705 deg. Cent.—1,301 deg. Fah.—with a temperature of maximum intensity of about 730 deg. Cent.—1,364 deg. Fah. He thought there might be some doubt as to how these figures were arrived at, and stated that they were obtained from the cooling curve.

THE VALUE OF VANADIUM AND CHROMIUM.

Professor Harbord referred to the method of making tests in bulk for such materials as rails. This was so expensive that it would be infinitely better if some simple means—as in the case of impact tests—could be adopted, but at present the great objection lay in the irregularity of the results. He would like to ask Mr. Seaton if he obtained the same irregularity. The method adopted by Breuil and Volga was then briefly described, which consisted of clamping one end of the test piece firmly in a vice and allowing a weight to drop on the free end. With regard to the question of notching the bars, he pointed out that Breuil and Volga had come to the conclusion that it was better to leave the bar quite plain, with no notch of any description. He asked Mr. Kent-Smith if he could say how much the vanadium and how much the chromium respectively had to do with the properties

THE MAITLAND EXPERIMENTS.

STANDARDISATION OF TESTS.

TESTS AT THE CRITICAL TEMPERATURE.

Mr. Kent Smith said he would answer most of the questions in writing. With regard to Dr. Carpenter's remarks on the thermo-electric and differential methods for recalescence determinations, he knew they were best the same and considered they they ought to have substituted "electric resistance" method, as it was a more suitable term. With regard to the tests at the critical temperature, he would give some interesting results in the report that had recently been obtained at temperatures varying from 600 deg. to 720 deg. Dr. Carpenter had only been able to obtain one retardation point, but Mr. Kent-Smith stated that they—the authors—had certainly obtained two. In answer to Professor Harbord as to how much the percentage of vanadium and chromium respectively was responsible for the physical properties of the steel, Mr. Kent-Smith explained that by increasing the amount of the latter, a higher stress was obtained, and with a static stress of 38 tons per square inch the steel practically keeps the ductility of the raw material.

FARADAY SOCIETY.

The tenth ordinary meeting of the Faraday Society was held on Monday, December 19th, 1904, at the Institution of Electrical Engineers, M. J. Swinburne, vice-president, occupying the chair.

M. Adolphe Minet communicated Part II. of his paper on "The Electric Furnace: Its Origin, Transformations, and Applications."

Dr. F. Mollwo Perkin read a paper by himself and Mr. W. C. Prebble on the "Electrolytic Analysis of Cobalt and Nickel."

Mr. F. Gelstharp presented two short papers entitled "The Electrolytic Preparation of Tin Paste" and "Note on the Electrolytic Recovery of Tin" respectively.

The author first describes briefly the original Indian mode of making tin paste—which is used for the production of metallic paper and other ornamental purposes—and the chemical process as generally carried out. The latter is troublesome on account of fumes, and some of the tin is precipitated as bright crystals, which are useless for this purpose. Moreover, the electrolytic processs is less costly, in spite of the low current efficiency (50 per cent.), and can be worked continuously. The process consists in dissolving anodes of tin, roughly cast from commercial ingots, in dilute hydrochloric acid, and depositing the metal in the form of sponge on cathodes of block tin or tinned iron. The current density of the cathode is 270 amperes per square meter. The electrolyte is kept in a state of rapid circulation. The deposited sponge is allowed to grow to a thickness of about an inch, and is then scraped off the cathodes. It then floats to the top of the bath, and is scooped away. To produce a cwt. of paste a week requires a generator of 150 amperes 1·5 to 2 volts.

ELECTROLYTIC RECOVERY OF TIN.

Mr. Gelstharp's second note describes an experiment that has some bearing on the conditions necessary for electrolytically stripping tin plate. A current was sent through an electrolyte of pure caustic soda at a temperature of 80 deg. C. by means of an anode and cathode of tin plate. The voltage was 3, but a current of only ⅛ ampere passed through the cell; there was very little gassing and the tin did not strip from the anode, but became coated with a light-brownish adherent deposit. The author considers this to be an oxide of tin. Upon reversing the current for an instant and then reversing again, a current of 1½ amperes at 1 volt passed freely, and the tin was effectively dissolved, due to the reduction of the oxide film to metal by the hydrogen evolved at the moment of reversal.

The deposited tin generates hydrogen in water; the author considers that besides containing an alloy of tin and hydrogen, tin paste deposited from an alkali solution also contains sodium.

Agitation of the cathode is of great importance in tin recovery; a quick succession of shocks by reducing polarisation reduces the consumption of energy by 30 to 40 per cent.

Finally, the acid and alkali processes for tin recovery are compared. The former is the more suitable for making tin paste and the latter for tin recovery from scrap.

INSTITUTE OF MARINE ENGINEERS.

FUEL ECONOMY BY INSULATION.

At a recent ordinary meeting Mr. R. B. Lockhart contributed a paper on this subject, of which the following is an abstract:—

The subject may be divided into three sections, insulations of heat, of cold, and of sound, but the author deals only with the first. The author refers to losses by radiation, which seldom receives the consideration it deserves, and makes comparison between twenty-four different classes of non-conductors. Hair felt, as might be expected, tops the list, but is, of course, open to the objection of being inflammable. Among non-inflammable materials it is well-known

OBITUARY.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Erith.—Four contracts in connection with the Electric Tramways. Particulars of Messrs. Hawtayne and Zeden, 6, Queen Street Place, London, E.C. Tenders to Mr. C. H. Fry, Clerk ... ... Last Day. Jan. 9

Bradford. Electric lighting Dudley Hill new schools. Mr. Wilson Bailey, Tanfield Buildings, Market Street ... ... Jan. 9

Newton Abbot. — Construction of a masonry reservoir, to contain 85,000 gallons, and providing and laying 900 ft. of 4-in cast iron mains. Mr. Samuel Segar, Engineer, Union Street, Newton Abbot ... ... Jan. 10

Islington. Construction of steel water-storage tank to hold 250,000 gallons, and of cast-iron pumping mains at Public Baths, Hornsey Road, Upper Holloway. Borough Engineer, Mr. J. Patten Barber, Town Hall, Upper Street, N. ... ... Jan. 11

Burma Railway.—Bridge work, 150 ft. and 30 ft. spans, pillars, posts, etc., for fencing, eye bolts and strand wire, and Portland cement. Secretary, 76, Gresham House, London, E.C. ... ... Jan. 11 & Jan. 12

Belfast.—Supply and erection at new infectious diseases hospital, of boilers and electric light installations, including engines, dynamos, etc. Mr. Samuel Black, Town Clerk ... ... Jan. 12

Bettws-y-coed.—Construction of waterworks extensions, about seven miles, and an embankment. Mr. E. R. Owen, Union Offices, Llanwrst .. .. Jan. 12

Spain.—Supply of revolving platforms (Contract 1), steel rails (Contract 2), in connection with the improvements at the Port of Valencia. Particulars of the Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street. Tenders to Port Administration, Valencia ... ... Jan. 16 & Jan. 14

London.—Construction, supply, and erection for the South London Electric Supply Corporation at their works, of one 750 kw. steam alternator, etc. Secretary, Bengeworth Road, Loughborough Junction ... Jan. 16

Dover.—Construction of about 1¼ miles of double line of light railway to River, including the supplying and laying of steel girder rails, etc. Borough Engineer, Maison Dieu House, Dover ... ... Jan. 16

Egremont. — Building two twin-screw saloon steamers for the passenger ferry service on the river Mersey for the Ferries Committee of the Wallasey Urban District Council. Ferries Manager, Egremont Ferry ... ... Jan. 16

Amsterdam.—Supply of cast-iron mains and additional parts for a drinking water conduit to a weight of about 1,176,000 kg. in two lots. Particulars of Wed. P. van Waesberge and Zoon, Houttuin 73, Rotterdam ... ... Jan. 16

Gravesend.—Electric lighting of King Street, National Schools. Mr. C. F. McInnes, Electricity Works ... ... Jan. 16

Rochdale.—Supply of points and crossings for the Corporation. Mr. S. S. Platt, Borough Surveyor, Town Hall ... ... Jan. 16

Ripon.—Retubing condensers for the Corporation. The Gas Manager, Ripon ... Jan. 18

Newport (Mon.). — Construction and erection of a steel, arched suspension roadway bridge over River Usk at Kemeys. County Surveyor, Newport ... ... Jan. 19

Kidderminster. — Erection of engine house, boiler house, and provision, laying and jointing of 800 yds. 10 in. cast-iron main, in connetion with water supply. Engineers Messrs. Wilcox and Raikes, 63, Temple Row, Birmingham ... ... Jan. 20

London.—The County Council invite tenders for the road-work and plate-laying required for the construction of electric traction on the conduit system for the authorised tramway in Rosebery Avenue. Particulars of Chief Engineer, Spring Gardens, S.W. ... ... Jan. 24

Spain.—The Gaceta de Madrid of December 17th contains a notice calling for tenders for the construction of lighthouses at Cape Lebeche and Tramontona, Balearic Isles, at the upset price of 137,185 pesetas (about £4,033). The estimate, conditions, and plans may be seen in the Ministry of Agriculture, Industry, Commerce, and Public Works, Madrid ... ... Jan. 25

Leicester.—Construction and erection of steel roofs for the engine and boiler houses of the Beaumont Leys effluent pumping station. Mr. Geo. Mawbey, Town Hall, Leicester ... ... Jan. 25

Johannesburg.—Supply of vignoles, rails, fishplates, angle steel guard rails, etc., for Municipal Tramways. Mordey and Dawbarn, 82, Victoria Street, S.W. ... Jan. 26.

Port Elizabeth.—Supply of materials in connection with Corporation Electricity Supply Works. Section A: Boiler-house plant; Section B: Engine-room plant; Section C: Electricity supply mains; Section D: Accumulators and boosters; Section E: Switchboards and instruments; Section F: Cranes; Section G: Public Lighting; Section H: Meters; Section I: Workshop equipment. Messrs. Davis and Sopel, Agents, 54, St. Mary Axe, London, E.C. ... ... Jan. 26

Bootle. [illegible] plant [illegible] electric [illegible] Corporation [illegible] Town Hall ... [illegible] 14

Drax (Selby). [illegible] tender [illegible] electric light installation, electric pump, etc. Mr. W. [illegible] [illegible] 28

Edinburgh. [illegible] appliances, including gas exhausters [illegible], water-tube condensers, Pelouze and Audouin [illegible] Mr. [illegible] Edinburgh ... [illegible]

Brisbane.—Supply of 2,000 tons steel rails and 168 tons of steel fishplates. Chief Engineer, Brisbane, or Agent-General, [illegible] Queensland, 1, Victoria Street, London, S.W. ... ... Mar. 7

CONTRACTS CLOSED.

Greenock.—Scott's Shipbuilding and Engineering Company [illegible] an order [illegible] Company, Ltd.

Port Glasgow. [illegible] Company of New Zealand.

Dudley. [illegible] and Co. [illegible] received from the South Stafford- [illegible]

Lowestoft. [illegible] W. F. [illegible] and Co. [illegible]

Paddington. [illegible]

Admiralty. [illegible] the whole of the electrical equipment [illegible]

Belfast.—J. J. White and Co., Ltd., have received the [illegible] per minute [illegible] and [illegible]

Monte Video. [illegible]

Mansfield. [illegible]

Kirkby-in-Ashfield.—The contract for the [illegible] of the new gas works has been placed with [illegible] and Sons, Ltd., at the price of £13,840.

Leeds. An order for 850 tons of steel tramway rails has been placed with Walter Scott, Ltd., at £5 7s. 6d. per ton.

COMING CONTRACTS.

Chapel-en-le-Frith. The Council are about to raise a loan [illegible] for carrying out a water scheme.

Eastbourne. An inquiry has been held into the application [illegible] to borrow £3,500 for purchasing [illegible] and for sewerage works.

North-Western Indian Railway. A line of [illegible] to be constructed by the company [illegible] Sangla. Particulars may be obtained from the [illegible] Lahore.

Huddersfield. The Council is about to make electric lighting extensions.

Burnley. A considerable sum is to be spent in the building and equipment of a new technical school.

Chili. The Government have now authorised the expenditure [illegible]

Penrith. An inquiry has been held [illegible] Council [illegible] to borrow £[illegible] for [illegible]

Pudsey. [illegible]

St. Pancras.—The L.C.C. has agreed to lend Borough Council [illegible] electric supply purposes.

Bournemouth. The Town Council is about to apply [illegible] improvements.

APPOINTMENTS VACANT.

Last Day.

Huddersfield. [illegible] Huddersfield Technical College ..

Chelsea. [illegible] .. Jan. 12

APPOINTMENTS FILLED.

Sunderland.—Mr. L. D. Conesland has been appointed Head of the Civil and Mechanical Engineering Department of the Technical College.

Metropolitan District Railway. [illegible]

Glasgow and South-Western Railway. [illegible]

Midland Railway Company. [illegible]

Nottingham. Mr. [illegible] Nottingham Corporation water [illegible]

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows:—

Consols: February 1st. General Settlements: January 13th, 27th, February 10th. Bank Rate, April 21st, 3 per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed	Shares	Last Div. dend	Name	Paid up	Closing Prices
11,270	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	3 — 3½
10,000	5	3/-	Do. Cum. Pref. 6 per cent. ..	5	4¼ — 4¾
3,210,000	1	2/6	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3⅝ - 3⅝
76,970	5	2/-	Do. 4% Cum. Pref.	5	5⅜ — 5⅝
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	100 —102
£100,000	100	1¼%	Aveling and Porter, Ltd., 1¼% Reg. Mt. Debs. Red.	100	96 — 99
530,000	1	1/7½	Baldwin and Wilcox, Ltd., Ord.	1	3⅛ — 3⅜
100,000	1	7½d.	Do. „ 6% Cum. Pref.	1	1⅜ — 1⅝
20,000	5	3/-	Baker (Joseph) and Sons, Ltd. 6% Cum. Pref.	5	5 — 5½
250,000	1	6d.	Baldwins, Ltd., 5½% Cum. Pref. ..	1	1 — 1¼
£250,000	Stk	1¼%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	99 —101
150,000	4½	2/8	Barrow Hæmatite Steel Co., Ld., O.	4½	1⅞ — 1⅝
50,000	4½	6/-	Do. Do. Cum. 2nd. Pref.	4½	4¼ — 4¾
33,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾ — 5¼
£500,000	100	—	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50%, pd		99 —101
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11¾ — 12¼
£396,600	Stk	4%	Do. 4% Deb. Stock, Red.	100	98 —100
149,850	1	6d.	Bengal Iron and Steel Ord.	1	1 — 1¼
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	1⅛ — 1⅜
300,000	1	6d.	Do. 5½% Cum Pref. ..	1	⅝ — ¾
£300,000	Stk	4½%	Do. 4½% Red. Deb. Stock	100	94 — 97
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	⅛ — 1⅛
1,860,900	1	3½d.	Do. Nos. 1,639,101-3,500,000	1/-	⅛ — ⅜
1,160,000	1	1½d.	Brown (John) and Co., Lim., Ord. .. Nos. 1-1,160,000	15/-	1¼ — 1⅜
590,000	1	6d.	Do. Ord., Nos. 1,160,001-1,750,000	1	1¼ — 1½
74,000	10	5/-	Do. 5% Cum. Pref. ..	10	11 —11½
154,500	5	2/6	Cammell, Laird & Co., Ltd., Ord. ..	5	8 — 8½
232,500	5	2/6	Do. 5% Cum. Pref. ..	5	5⅛ — 5½
450,000	1	1/6	Clayton & Shuttleworth, Ltd., Ord.	1	⅛ — ¼
70,000	5	2/6	Do. 5% Cum. Pref. ..	5	5¼ — 5½
£250,000	Stk	4%	Do. 4% 1st Mort Db. Stk. Red	100	100 — 102
100,000	10	30/-	Consett Iron Co., Ltd., Ord. ..	7½	31 — 33
75,000	1	2/6	Delta Metal, Ltd. Shares	1	1⅞ — 2⅛
1,259,594	1	3½d.	Dorman, Long & Co., Ltd.	1	⅝ — ¾
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	90 — 93
£250,000	Stk	—	Do. 6% 2nd Mort. Deb. Stk., Red.	—	94 — 96
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating.	5	2¼ — 2⅜
250,000	1	9½d.	Dunlop (James) & Co., Ltd., Ord...	1	⅞ — ¼
300,000	1	7½d	Do. 6% Cum. Pref.	1	⅝ — ¾
4,721	13	12/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	8½ — 9⅝
69,754	13	12/-	Do. do. do.	10	7⅛ — 7⅝
20,250	10	8/-	Elliott's Metal, Ltd.	8	5 — 5¼
5,000	10	5/-	Do. Cum. Pref. 5%	10	9 — 9⅜
186,748	Stk	4%	Do. Deb. 4%	100	95 — 100
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref. ..	10	10½ — 11½
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk. Red.	100	99 — 102
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord. ..	3	4½ — 4⅝
21,000	3	1/6	Do. 7½% Cum. Pref.	3	5⅝ — 6
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2⅝ — 2⅝
344,000	5	2/6	Do. 5% Cum. Pref.	5	5¼ — 5⅜
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	103 —105
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref. ..	5	2¼ — 3⅛
250,000	1	1/-	Hadfield's Steel F'dry Co., Ld., Ord.	1	3 — 3⅛
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10¾ — 11
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref...	5	5 — 5⅛
408,565	1	1/6	Harvey United Steel Co., Ltd. ..	1	1⅝ — 1⅞
28,003	5	7/-	Head, Wrightson & Co., Ltd. ..	5	6¾ — 7
85,000	1	7½d.	Hill (Richard) & Co. (1899) Ltd., Ord.	1	⅜ — ⅝
18,000	5	3/-	Do. 6% Cum. Pref.	5	4½ — 4¾
30,000	10	6/-	Hornsby (Richard) & Sons, Ld., Ord.	8	5⅝ — 6¼
750,000	1	6d.	Howard & Bullough, Ltd., Ord. ..	1	1⅜ — 1⅝
25,000	10	6/-	Do. 6% Pref. (Non-Cum.) ..	10	12¾ - 13
£250,000	Stk	4%	Do. 4 Deb. Stk., Red. after 1905	100	94 — 97

ENGINEERING, IRON, AND STEEL COMPANIES. *Contd.*

Present Amount Subscribed	Shares	Last Div. dend	Name	Paid up	Closing Prices
37,500	10	20	Kynoch, Ltd.	10	18 — 18½
49,537	10	5%	Do. Cum. Pref. 5%	10	10¾ 10⅝
300,000	1	4½d	Lambert Bros., Ltd., Ord.	1	⅜ — ½
50,000	5	2/6	Do. 5% Cum. Pref	5	4 — 4¼
40,000	3	2/1½	Leeds Forge Co., 7% Cum. Pref. ..	3	3½ — 4½
200,000	1	7½d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	1⅜ — 1⅝
£300,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk., Red.	100	108 —110
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11 — 11½
210,000	1	6d.	Measures Bros., Ltd., Ord.	1	⅝ — ¾
75,000	1	6½d.	Do. 5% Cum. Pref.	1	⅝ — ¾
£75,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk., Red.	100	96 — 99
21,943	5	2/6	Muntz Metal, Ltd.	5	4¼ — 5⅛
14,248	5	5%	Do. Pref. 5%	5	4⅝ — 5⅛
5,000	62½	17/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	73 — 75
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	11¼ — 12
80,000	5	-	North-Eastern Steel Co., Ltd., Ord.		
£250,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	90 — 93
122,000	5	2/-	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	3⅝ — 4
50,000	5	3/-	Do. 6% Cum. Pref. "A" ..	5	5⅛ — 6⅛
70,000	10	6/-	Pease & Partners, Ltd., Ord. ..	10	9¼ — 10¼
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock .	100	97 —100
20,000	5	3/-	Peebles(Bruce) & Co., Ld., 6% Cm. P.	5	4¾ — 5
230,000	1	—	Projectile Co. (1902), Ltd., Ord. ..	1	⅜ — ⅝
126,858	5	2/-	Rhymney Iron Co., Ltd.	5	1⅝ — 1⅞
73,062	5	2/-	Do. New	5	1⅛ — 1⅜
£330,000		5%	Do. 5% Mort. Deb., Red. ..	100	99 — 102
350,000	1	7½d.	Richardsons, Westgarth & Co., Ltd., 6% Cum. Pf. ..	1	⅝ — ¾
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock ..	100	94 — 96
35,000	10	12/-	Ruston, Proctor & Co., Ltd.... ..	10	9½ — 9⅝
275,000	1	6d.	Scott (Walter), Ltd., Ord.	1	⅜ — ⅝
300,000	1	7½d.	Do. 6% Cum. Pref.	1	1 — 1¼
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	93 — 95
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ltd. 1st Charge 5% Debs., Red ..	100	90 — 93
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	91 — 95
250,000	1	1/-	South Durham Steel & Iron, Ltd. Ord.	1	⅜ — ⅝
300,000	1	—	Do. 6% Cum. Pref.	1	⅝ — ¾
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	85 — 90
25,000	10	—	Stephenson (Robert) & Co., Ltd., Or.	10	13¾ — 14
25,000	10	5/6	Do. 5½% Cum. Pref. ..	10	3¾ — 4
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	76 — 78
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord. ..	10	17 — 17½
55,000	10	6/-	Do. 6% Cum. Pref.	10	14 — 14½
634,732	1	4.69d.	Swan, Hunter & Wigham Richardson, Lim. Ord.	1	⅞ — 1
538,845	1	6d.	Do. 5% Cum. Pref.	1	⅞ — 1
£240,000	Stk	4½%	Do. 4½ 1st Mort. Deb. Stk. Red	100	96 — 99
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	½ — ⅝
£200,000	100	4%	Do. 4 Irredeem. 1st Mort. Deb.	100	67 — 70
£160,000	1	7½d.	Thornycroft (John I.) & Co., Ltd. .. 6% Cum. Pref.	1	⅜ — ½
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9⅜ — 10
$58,195,200	$100	8%	United States Steel Corp. Com. Stk.	$100	31½ — 31⅝
$36,314,100	$100	8%	Do. 7% Cum. Pref. Stock	$100	99⅜ — 99⅝
$162,268,000	$1000	5%	Do. 10-60yr. 5% Skg. Fd. G. Bds.	$1000	95 — 97
3,350,000	1	1/-	Vickers, Sons & Maxim, Ltd. Ord. ..	1	2⅝ — 2¾
750,000	1	6d.	Do. 5% Non-Cum. Pref. ..	1	1⅝ — 1⅞
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock	100	111 —114
£1,250,000	Stk	4%	Do. 4 1st Mort. Deb. Stk. Red.	100	103 — 105
£1,000,000	100	4%	Do. 4 2nd Mort. Debs., Red.	100	103 —105
225,000	1	1½	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	⅜ — ⅝
500,000	1	7½d.	Do. 6% Cum. Pref. Ord. ..	1	⅝ — 1
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	85 — 89
7,637	5	2/9	Weldless Steel Tube, Ltd., Cum. Pref. ..	5	4¼ — 4⅞
300	Stk	4½%	Do. Mort. Deb. 4½	100	93 — 98
66,666	5	3/-	Williams & Robinson, Ord.	5	1 — 2
66,666	5	3/-	Do. 6% Cum. Pref.	5	2 — 3
£246,641	Stk	4%	Do. 4 1st Mort. Deb. Stk. Red	100	74 — 79
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½ 1st Mort. Deb. Stk. Red.	100	80 — 85

Stocks and Shares marked ‡ are quoted ex-dividend.

ELECTRICAL MANUFACTURING COMPANIES.

70,000	1	6d.	Alliance Elec. Co., Ltd. 5%, Cum. Pf.	1	[illegible]
[illegible]	1	7d.	[illegible] Motor Ltd. [illegible] Cum. Pf.	1	[illegible]
120,000	1	[illegible]	[illegible] Co., Ltd.	1	[illegible]
[illegible]	5	[illegible]	Br[illegible] Hoists, Cables, Ltd., Ord.	5	[illegible]
100,000	5	[illegible]	Do. [illegible] Cum. Pref.	5	[illegible]
[illegible]	Stk	4½	Do. [illegible] 1st Mort. Deb. Stk. Rd.	100	101 104
£200,000	Stk	[illegible]	[illegible] HoustonCo., Ltd., 4[illegible] Mort. Deb. Stk. Red.	100	101 103
300,000	[illegible]	3	[illegible] Electrical and [illegible] Co., Ltd., [illegible] Pref.	[illegible]	2 2½
[illegible]	Stk	4	Do. [illegible] Mort. Deb. Stk. Red.	100	86 [illegible]
[illegible]	2	[illegible]	B[illegible] Eng. Co., Ltd. Ord.	2	[illegible]
[illegible]	2	[illegible]	Do. [illegible] Pref.	2	1½ [illegible]
£[illegible]	Stk	4[illegible]	Do. [illegible] Perp. 1st Deb. Stk.	100	[illegible]
£125,000	Stk	4½	Do. [illegible] Perp. [illegible] Deb. Stk.	100	72 — 75
[illegible]	5	[illegible]	[illegible] Cat[illegible] Ltd. Ord.	5	[illegible]
[illegible]	5	[illegible]	Do. Cum. Pref.	5	5 [illegible]
£[illegible]	Stk	[illegible]	Do. [illegible] 1st Mort. Deb. Stk. Red.	100	103 105
[illegible]	3	[illegible]	C[illegible] Co., Ltd.	3	1 — 2
[illegible]	—	[illegible]	Do. [illegible] 1st Mort. Reg. Debs.	100	93 — 98
2,000	5	10	[illegible] Co., Ltd., Ord. ..	5	[illegible]
[illegible]	[illegible]	8	Do. [illegible] Cum. Pref.	[illegible]	5½
£[illegible]	Stk	4½	Do. [illegible] Deb. Stock, Red.	100	10[illegible] 107
[illegible]	1	6d	Doulton & Co., Ltd., 5% Cum. Pref.	1	[illegible]
£[illegible]	Stk	4	Do. 1st Mort. 4 [illegible] Deb. Stk.	100	10[illegible] 108
[illegible]	5	[illegible]	Edison and Swan United Electric Light, Ltd. "A" Shares Nos. 1 to 2[illegible]	3	[illegible]
17,1[illegible]	5	[illegible]	Do. "A" Shares No. [illegible] 017 1[illegible]	5	1 1
£[illegible]	Stk	4	Do. [illegible] Deb. Stock Red.	100	78 83
£100,000	Stk	[illegible]	Do. Second Deb. Stk. Red.	100	79 84
112,100	2	[illegible]	Electric Construction Co., Ltd. .	2	1½ [illegible]
11,890	2	[illegible]	Do. 7% Cumulative Pref. .	2	2½ [illegible]
£200,000	Stk	4	Do. 4 Perp. 1st Mt. Deb. Stk.	100	98 100
10,24[illegible]	10	7[illegible]	[illegible] Co., Ltd.	10	[illegible]
£100,000	Stk	[illegible]	[illegible], Ltd., [illegible] 1st Mort. Deb. Stock, Red.	100	90 95
[illegible]	10	[illegible]	Gen. Elect. Co. (1900), Ltd. [illegible] Cum. Pref.	10	9½ 10
£[illegible]	Stk	4	Do. 4 1st Mt. Deb. Stk. Red.	100	91 96
[illegible]	5	[illegible]	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	10[illegible] 10[illegible]
[illegible]	5	[illegible]	Do. 4½ Cum. Pref.	5	[illegible]
£50,000	Stk	4[illegible]	Do. 4½ Mt. Deb. Stk. Red.	100	110 112
[illegible]	10	5	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	[illegible]
£300,000	100	4	Do. 1st Mort. Deb. Red. .	100	99 102
7,[illegible]	10	[illegible]	Parker, Thos., Ltd. ..	10	6 7
7,[illegible]	12	12	Telegraph Construction and Maintenance Co., Ltd.	12	38 40
£1[illegible]	100	[illegible]	Do. 4%, Deb. Bonds ..	100	101[illegible] 104[illegible]

III.—ELECTRIC TRACTION.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7½ [illegible]
[illegible]	[illegible]	[illegible]	Barcelona Trams Co., Ltd., Ord. ..	10	[illegible]
[illegible]	100	[illegible]	Do. [illegible]	100	98 10[illegible]
[illegible]	1	[illegible]	Do. Cum. Pf.	1	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

ELECTRIC TRACTION.—*Contd.*

Amount	Share	Div.	Name	Paid	Closing Prices
£220,000	100	[illegible]	Buenos Ayres Gd. Nat., Ltd., [illegible] 1st Deb. Bds.	100	98 101
102,268	5	[illegible]	Calcutta Tramways Co., Ltd.	5	[illegible]
£[illegible]	Stk.	4[illegible]	Do. 4½%, 1st Deb. Stk., Red.	100	106 108
[illegible]	1	1	Cape Electric Tramways, Ltd.	1	1[illegible] 1
[illegible]	[illegible]	[illegible]	City of Birmingham Trams Co., Ltd. 5% Cum. Pref.	5	[illegible]
£300,000	100	4	Do. 4 1st Mort. Debs. .	100	98 102
15[illegible]	[illegible]	[illegible]	City of Buenos Ayres Trams Co., Ld.	[illegible]	10[illegible] 1[illegible]
£11[illegible]	Stk	[illegible]	Do. Per. [illegible] Deb. Stk.	100	140 145
£120,000	Stk	[illegible]	Colombo Elec. Tram & Light Co., Ltd., [illegible] 1st Mort. Deb. Stk. Red.	100	101 104
[illegible]	10	[illegible]	Dublin United Trams. (1896), Ltd., Ord. ..	10	13 14
[illegible]	10	6	Do. 6% Pref.	10	15 16
30,000	[illegible]	[illegible]	Isle of Thanet Elec. Trams and Light Co., Ltd., 5% Cum. Pref.	[illegible]	3½ 4
£150,000	Stk.	4	Do. 4 Deb. Stock .	100	88 91
125,000	[illegible]	[illegible]	London United Trams. (1901), Ltd., [illegible] Cum. Pref.	10	10[illegible] 10[illegible]
£1,031,000	Stk.	4	Do. 4 1st Mort. Deb. Stk. Red.	100	101 — 105
£50,000	Stk	[illegible]	Madras Electric Trams (1904), Ltd., 5% Deb. Stk. Red. .	100	101 — 10[illegible]
314,016	1	[illegible]	Metropolitan Elec. Trams, Ltd., Def.	1	[illegible]
[illegible]	1	[illegible]	Do. 6 Cum. Pref.	1	[illegible] 1
£3[illegible]	Stk	4½	Do. 4½ Deb. Stock, Red.	100	102 — 104
50,000	[illegible]	[illegible]	New General Traction Co., Ltd. [illegible] Cum. Pref. .. .	[illegible]	[illegible]
110,923	[illegible]	[illegible]	North Metropolitan Tramways Co.	[illegible]	[illegible]
£1[illegible]	100	[illegible]	Do. 3½ Mort. Debs.	100	90 9[illegible]
£196,200	Stk	[illegible]	Perth Electric Trams, Ltd. (W.A.) [illegible] 1st Mort. Deb. Stock Red.	100	101 104
24,500	10	[illegible]	Potteries Elec. Traction Co., Ltd. Ord.	10	8 — 9
24,500	10	[illegible]	Do. [illegible] Cum. Pref.	10	8½ — 9½
£220,000	Stk	4½	Do. 4½ Deb. Stk., Red.	100	99 102

IV.—ELECTRIC LIGHTING AND POWER.

Amount	Share	Div.	Name	Paid	Closing Prices
7,500	10	[illegible]	Bournemouth & Poole Elec. Sup. Co., Ltd. Ord.	10	12 — 13
7,500	10	[illegible]	Do. 4½ Cum. Pref. .	10	9½ 10
7,500	10	6	Do. 6 Cum. Second Pf. ..	10	11 — 12
£70,000	Stk	4	Do. 4½ Deb. Stock Red.	100	102 — 10[illegible]
11,000	[illegible]	[illegible]	Brompton, Kent Elec. Lt. & Pr. Co., Ltd.	[illegible]	[illegible]
£50,000	Stk	4½	Do. [illegible] 4½ 1st Deb. Stk. Red.	100	101 — 104
27,[illegible]	[illegible]	[illegible]	Brompton & Kensington Elec. Supply Co., Ltd. Ord.	5	10½ 11
12,[illegible]	[illegible]	[illegible]	Do. 7 Cum. Pref. Shares	[illegible]	10[illegible] — 10[illegible]
[illegible]	[illegible]	[illegible]	Calcutta Elec. Sup. Corp. Ltd., Ord.	[illegible]	[illegible]
£[illegible]	[illegible]	4	Central Elec. Sup. Co., Ltd., [illegible] Deb. Stk. .	100	104 107
70,000	[illegible]	[illegible]	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord. .	[illegible]	[illegible]
10,000	[illegible]	[illegible]	Do. do. Ord. .	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	Do. do. [illegible] Cum. Pref.	[illegible]	[illegible]
£[illegible]	[illegible]	[illegible]	Do. do. [illegible] Deb. Stk. Red.	100	101 — 10[illegible]
[illegible]	[illegible]	[illegible]	Do. do. [illegible] Cum. Pref.	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	Do. do. do. ([illegible])	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	Chelsea Elec. Sup. Co., Ltd. Ord.	[illegible]	[illegible] 7
£1[illegible]	[illegible]	[illegible]	Do. [illegible] Deb. Stk. Red.	100	107 10[illegible]
[illegible]	1[illegible]	[illegible]	City of London El. Lghtg. Co., Ld., O.	10	10[illegible] 11[illegible]
[illegible]	[illegible]	[illegible]	Do. [illegible] Cum. Pref.	[illegible]	13[illegible] 14
[illegible]	[illegible]	[illegible]	Do. [illegible] Deb. Stk., Red ..	100	[illegible]
[illegible]	[illegible]	[illegible]	Do. [illegible] 2nd Deb. Stk. Red.	100	101 — 10[illegible]
[illegible]	[illegible]	[illegible]	County of London Elec. Supply Co., Ltd. Ord.	[illegible]	[illegible]
[illegible]	10	[illegible]	Do. [illegible] Cum. Pref.	10	12 — 1[illegible]
£[illegible]	[illegible]	4½	Do. 4½ Deb. Stk. Red.	100	107 110
£[illegible]	—	[illegible]	Do. 4½%, 2nd Deb. Stk., Prv. [illegible]	[illegible]	101 — 10[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	Do. [illegible] Cum. Pref.	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	100	107 — 109
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] — 91
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	100	[illegible] — 10[illegible]
[illegible]	[illegible]	[illegible]	[illegible] Ltd. ..	[illegible]	[illegible] — 10[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7½ [illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] — 13

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed	Shares	Last Divi dend	Name	Paid up.	Closing Prices.
£135,000	Stk	4½	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4½% Deb. Stock, Red.	100	102 —104
111,000	3		London Elec. Supply Corp., Ld., Ord.	3	2⅛ — 2⅜
60,000	5	3/-	Do. 6% Pref.	5	5⅛ — 5⅜
£371,895	Stk	4½	Do. 4% 1st Mort. Db. Stk., Red.	100	95 — 97
100,000	10	9/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	17½ — 18
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5⅛ —5⅜
220,000	Stk	4½	Do. 4½% 1st Mort. Db. Sk., Red.	100	110 —115
250,000	Stk	3½	Do. 3½% Mort. Deb. Stk., Red.	100	96 — 98
£250 000		4½	Midland Elec. Corp. for Power Distribution, Ld., 4½% 1st Mort. Deb.	100	92 — 95
10,852	10	6 -	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14½ — 15
£75,000	100	4½	Do. 4% 1st Mort. Debs. ..	100	101 —103
16,500	5	2/6	Oxford Electric Co. Ltd., Ord. ..	5	6¼ — 6⅜
£50,000	Stk	4½	Do. 4% Debenture Stk. Red.	100	99 —101
£84,700	100	4½%	Royal Elec Co. of Montreal) 4½% 20-yr. 1st Mort. Deb	100	100 —102
40,000	5	5/-	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13⅜ — 14½
20,000	5	3/6	Do. 7% Pref...	5	8⅛ — 9
£150,000	Stk	3½	Do. 3½% Deben Stock, Red	100	98 —100
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2⅜ — 3½
£50,000	Stk	4½	Do. 4½% Debenture Stk. Red.	100	83 — 87
65,000	5	3/-	South London Elec. Sup. Co., Ltd. O.	5	4⅛ — 4⅜
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	⅛ — ⅛
50,000	1	8½d.	Do. 7% Cum. Pref.	1	1⅛ — 1⅛
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	107 —110
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	5 — 5⅛
30,000	5	2/6	Do. 5% Cum Pref.	5	5⅞ — 6⅛
£200,000	Stk	—	Do. 4½% 1st Mort. Deb. Stk. Red	100	101 — 106
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	12⅜ — 13½
28,151	5	2/6	Do. 5% Cum. Pref.	5	6 — 6½

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed	Shares	Last Divi dend	Name	Paid up.	Closing Prices
£34,800	100	4½	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	99 —102
25,000	10	—	Amazon Telegraph Co., Ld. ..	10	1 — 1¼
£763,580	Stk	12/6	Anglo-American Tel. Co., Ltd., Ord.	100	57 — 59
£3,118,210	Stk	25/-	Do. 6% Preferred Ordinary	100	103 104
£3,118,210	Stk	2 -	Do. Deferred Ordinary ..	100	13⅜ — 13⅝
14,000	5	4/-	Chili Telephone Co., Ltd.	5	5⅞ — 6⅛
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	170 —190
£1,903,856	Stk	4½	Do. Steri 500 yr 4% Deb. Stk., Red.	100	92 — 94
15,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8½ — 9⅜
6,000	10	10/-	Do. 10% Preference ..	10	16⅝ — 17⅜
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3⅜ — 3⅝
		5/-	10% Cum. Preference	5	7⅛ — 8⅛
£30,000	50	4½%	Do. 4½% Debs...	50	100-102⅝
60,710	20	3 -	Direct U.S. Cable Co., Ltd. ..	20	10¾ - 11
£85,800	100	4½ %	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	99 —101
£300,000	100	4 %	East. & S. African, Ld., 4% Mt. Dbs.	100	101 —103
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	100-102⅝
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	13⅛ — 14
£802,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	106 —108
£1,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	135 — 138
£2,000,000	Stk	17/6	Do. 3 % Pref.	100	88 — 90
£1,856,814	Stk	4%	Do. 4% Mort. Deb. ..	100	105 107
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	28½ 29
£58 700	100	4½ %	Halifax and Bermudas Cable Co., Ltd., 4½ % 1st. Mort. Debs. Red.	100	99 101
17,000	25	12/6	Indo-EuroAsian Tele. Co., Ltd.	25	14¼ - 16⅛
72,680	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	3⅜ — 3⅝
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	108⅛ 109¼
£1,966 667	Stk	5%	Do. Deferred	100	102 104
15,000	10	6/-	Do. 6% Cum. 1st Pref.	10	13 15
15,000	10	6/-	Do. do. 2nd do.	10	12 13
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5⅛ 5⅜
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red.	100	96 — 98
£689,593	Stk	4%	Do. 4 % do. do. ..	100	101¼-103½
£1,0 0	—	5/9	Do. 4 % Prov. Certs. all paid..	–	101¼-103½
179,313	1	7½d.	Oriental Telephone & Elec. Co., Ltd.	1	1 1⅛
50,000	1	7½d.	Do. 6% Cum. Pref. ..	1	1¼ - 1⅜
£100,000	100	4%	Pacific & European Tel. 4% Guar.	100	96 99
11,839	8	4/-	Reuter's Telegram Co., Ltd.	8	7 — 7¼
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	6⅛ — 6⅜
40,000	5	2/6	Do. 5% Cum. Pref.	5	5 - 5⅛
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	104 -106
15,609	10	1/-	W. African Telegraph Co., Ltd. ..	10	7½ — 7¾

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed	Shares	Last Divi dend	Name	Paid up	Closing Prices
£30,008	2½		West Coast of America, Ltd. ..	2½	¾ - ⅞
150,000	100	4½	Do. 1st Deb. Guar. by West. Tel.	100	97 99
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	⅞ - 1
34,563	10	6/-	Do. 6% Cum. 1st. Pref.	10	7⅛ 7½
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	6½ 7½
£80,000	100	5%	Do. 5% Deb.	100	101 —103
207,930	10	3/-	Western Telegraph Co., Ltd. ..	10	13½ — 14
£75,000	100	5 %	Do. 5% Debs., 2nd Series, 1906	100	101 —103
518,945	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	101 102

VI.—SHIPPING COMPANIES.

Present Amount Subscribed	Shares	Last Divi dend	Name	Paid up	Closing Prices
32,500	10	5 6	Anchor Line (Henderson Bros.), Ltd., 6½% Cum. Pref.	10	8⅝ - 9
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	98 -100
£672,900	Stk	4½%	British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	91 - 93
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	6 7
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	73 — 76
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	98 100
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000. .	20	13 13½
40,000	20	8/-	Do. Nos. 60,001-100,000	10	5⅜ — 6½
£464,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	99 —101
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1 — 1¼
30,000	10	5/-	Do. 5% Cum. Pref. ..	10	9½ — 10¼
327,300	100	4½%	Do. 4½% 1st Mort. Debs. Red.	100	105 —107
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	4¼ — 4½
36,758	8	4/9	Do. Non-Cum. 6% Pref.	8	7¼ - 7½
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	95 97
55,000	5	1 3	Houlder Line, Ltd., Ord.	5	3 - 3⅜
40,000	5	2/9	Do. 5% Cum. Pref.	5	3¼ - 3½
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	83 - 86
141,500	10	5/-	Leyland (Fredk.) & Co. (1900), Ltd., 5% Cum. Pref. ..	10	5 — 5½
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	126 —129
£1,160,000	Stk	19%	Do. do. Deferred ..	100	214 —217
£800,000	Stk	3½%	Do. do. 3½% Deb. Stock..	100	99 —101
£648,100	Stk	3½%	Do do 3½ 2nd Deb. Stk.	100	96 - 98
15,000	100	30 -	Royal Mail Steam Packet Co. Ord..	60	23½ 24½
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4½ 5½
39,075	5	2/6	Do. "B" Ord...	5	4 4⅜
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8 — 8¼
24,000	10	4/6	Do. 4½% Cum. Pref... ..	10	9¾ - 10⅞
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	98 100

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed	Shares	Last Divi dend	Name	Paid up.	Closing Prices
60,000	1	9¾d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	⅞ - 1⅛
£750,000	Stk	5%	General Hydraulic Power Co., Ltd.	100	135 140
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 26
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	⅝ - ⅞
66,462	1	8·4d.	Do. do. Nos. 1 66,462	1	⅝ ⅞
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. .	1	1⅛ 1⅜
135,000	1	7½d.	Do. 6% Cum. Pref. .	1	1⅛ 1⅜

RAILWAY CARRIAGE & WAGON COMPANIES.

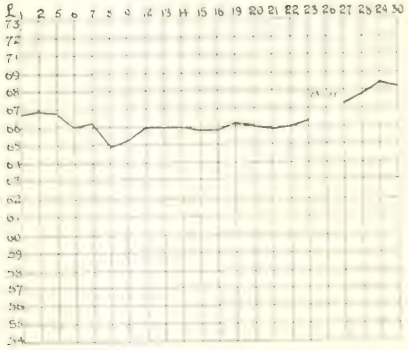
Present Amount Subscribed.	Shares	Last Divi dend	Name	Paid up	Closing Prices
10,000	10	7/6	Birm. Railway-Car, & Wagon, L.,	10	21 — 21½
8,739	10	3/-	Do. Second Issue 1-8,739 ...	4	8 — 8½
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000. .	10	13 13½
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,000	7	8½ - 9
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-50,000	7	4 4¼
781,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-781,808	1	39/- — 40/-
164,288	1	6d.	Do. Cum. A Pref. 5 .. 1-164,288	1	23/3 24/3
235,000	1	7½d.	Do. Cum. B Pref. 6 .. 1-235,000	1	27/6 28/6
20,000	20	20/-	Midland Rail.-Car. & Wagon, Ld., 1-20,000	10	18½ 19½
10,000	20	7½d.	Do. Pref. 6 per cent. 1-10,000		22·3 22·9

Stocks and Shares marked * are quoted ex-dividend.

THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM DECEMBER 1ST TO DECEMBER 30TH, 1904.

COPPER.



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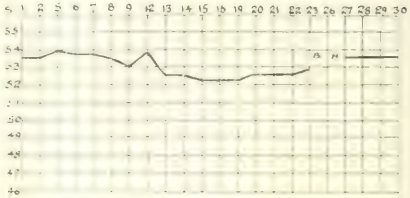

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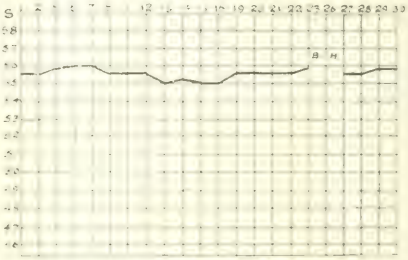

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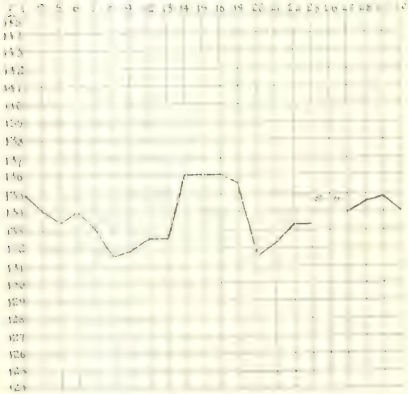

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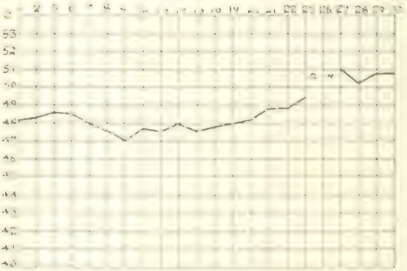

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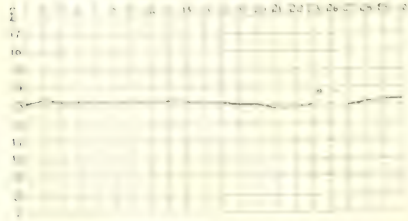
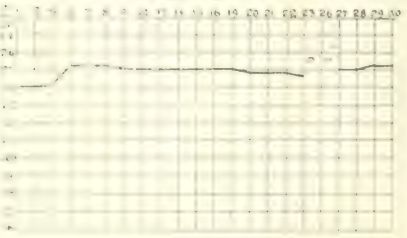


SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, January 4th, 1905.

IN spite of the interruption to business occasioned by the holidays, markets are decidedly bullish in tone, and dealings have been on a large scale. Copper in particular has been very active on buying orders from the Continent, and on large speculative purchases for the rise, with the result that the metal has risen sharply to £68 15s. The market closed yesterday with a firm tendency, and everything points to a continuance of the rise, the demand for the metal remaining on a very large scale, although the statistics just issued show that the visible supply is increasing.

Tin has been active, the sales of forward metal made by the bears in the hope of depressing prices being readily absorbed. Consumers are coming forward more freely, stocks are small, and the speculative position is more healthy, the heavy backwardation which was in evidence having to a large extent run off. On weaker Singapore advices the metal has had a sharp set back.

In the Lead market the feature has been the large speculative purchases for forward delivery.

Spelter has also moved upwards, although this section has been comparatively quiet. The position of the metal remains a strong one.

In the Iron and Steel section there have been lively speculative dealings in pig iron, due mainly to the report that shipments were being made to the States. The result was an excited Glasgow market in which Middlesbro' was rushed up to 51s. 6d. cash and near dates, and 51s. 9d. one month. Yesterday's market was not well attended, but Cleveland pig iron prices remained firm. Glasgow was closed.

The trade outlook is good, home business is improving, and in the United States a fresh outbreak of industrial activity is predicted.

There have been rather sensational developments in the Shellac market, and the long rise in prices has been suddenly and severely checked, Second Orange having given way to the extent of about 60s. per cwt. Market rumour suggests over-speculation as the reason for the fall.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal:—

	£	s.	d.
Steel:			
Siemens' Steel Plates, Marine Boiler Quality	6	15	0
" " " Land " "	6	17	6
" " " Ship Quality Plates	5	15	0
Siemens' Steel Bars, Boiler Quality	6	15	0
" " " Ship "	6	5	0
" " Angles	5	5	0
Manufactured Iron:			
Bars Dalzell	6	2	6
" Best	6	12	6
" " Horseshoe	6	12	6
" Angle	6	2	6
" Best Angle	6	12	6
" Best Best	7	2	6
" Extra Best	7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal):

	£	s.	d.	
Steel Angles (Glasgow Steel)	5	5	0	per ton.
Steel Ship Plates (Glasgow Steel)	5	15	0	"
Steel Bars, Ship Quality (Glasgow Steel)	6	5	0	"
Steel Bars, Boiler Quality (Glasgow Steel)	6	15	0	"
Steel Land Boiler Plates (Glasgow Steel)	6	5	0	"
Steel Marine Boiler Plates (Glasgow Steel)	6	5	0	"

Less 5 per cent discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Iron-works, Coatbridge, N.B., quotes:

	£	s.	d.
Bars—Phœnix	6	5	0
" Best	6	15	0
" Best Best	7	5	0
" Extra Best	7	15	0
" Best Horse Shoe	6	15	0
" Extra B H S	7	15	0
" Extra Best Cable	8	5	0
" Rivet	6	5	0
" Best Scrap Rivet	7	5	0

		£	s.	d.
Angles		6	5	0
	Best	6	15	
	Extra Best	7	5	0
Gas Tube Hoops		9	15	0
Plates—Phœnix				
	Best Boiler	7	10	0
		8	0	0
		9	0	0
Boiler Tube Strips		8	0	0

All prices for delivered Glasgow, Greenock, Grangemouth, Grangemouth Docks or Bowness. 5 per cent. Discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote (Commission extra):

Pig Iron:	No. 1.		No. 3.	
	£	s. d.	£	s. d.
Gartsherrie	3	4 0	2	14 6
Glenboig	2	18 6	2	14 6
Summerlee	2	18 6	2	13 6
Carnbroe	2	15 0	2	12 0
Langloan	3	1 0	2	14 0
Calder	2	18 6	2	13 6
Clyde	2	18 0	2	13 6
Glengarnock (Ardrossan)	2	18 0	2	12 6
Eglinton	2	13 6	2	11 0
Dalmellington (Ayr)	2	14 0	2	11 0
Shotts (Leith)	2	18 6	2	13 6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, at works:—

	£	s.	d.
W.W. Best	6	7	6
W.W. Best Bars	6	17	6
W.W. Best Best	7	7	6
W.W. Best Best Best	7	17	6
W.W. Best Steel	6	17	6
Treble Best	7	17	6
Double Best	8	7	6
Treble Best Best	9	7	6
Welded Steel Angles, Tees, &c.	10	0	0
Special Cross Tees	9	0	0
Best Steel Tee Bars	8	10	0
W.W. Steel Tees	6	10	0
W.W. Best Steel Bars	7	0	0
Best Best Steel Bars	7	7	6

Terms cash less 1/2 per cent. Discount for 14 days, following Monday.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd., Dallam and Bewsey Forges, Warrington,

	Iron.			Steel.		
	£	s.	d.	£	s.	d.
Crown Bars	8	10	0	7	0	0
Angles	7	0	0	7	10	0
Tees	7	10	0	8	0	0
W.W. Bars	7	0	0	7	10	0
Rounds	7	10	0	8	0	0

Open-hearth Bars, 5s. 6d. Liverpool to 10 ton Lots. Forges to Canal, and Carlisle as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport.

Black Sheets:	Singles 24G. to 26G. inclusive, 24in. by 36in. per ton			Doubles 21G. to 24G. inclusive, 26in. by 36in. per ton		
	£	s.	d.	£	s.	d.
Crown	10	0	0	10	10	0
Special	10	10	0	11	10	0
"Severn"	11	10	0	12	10	0
Best Crown Best	12	10	0	13	10	0
Charcoal	16	10	0	17	10	0
Best Charcoal	18	10	0	19	10	0

Picked and cropped and cross-rolled sheets specially quoted for.

Extra Singles: Singles to 66in. Doubles to 50in. Lattens to 46in. Extra Doubles: Singles to 108in. Doubles to 132in. Lattens to 108in.

Patent Coated Sheets:	Singles 24G. to 26G. inclusive, 24in. by 36in. per ton			Doubles 21G. to 24G. inclusive, 26in. by 36in. per ton		
	£	s.	d.	£	s.	d.
No. 1 Best	13	10	0	14	10	0
S.V. Best	15	0	0	16	0	0
No. 1 Best	15	0	0	16	0	0
S.V. Best	16	10	0	17	10	0

Tinned Sheets:	Singles 24G. to 26G. inclusive, 24in. by 36in. per ton			Doubles 21G. to 24G. inclusive, 26in. by 36in. per ton		
	£	s.	d.	£	s.	d.
Best Coke Plates	28	0	0	29	10	0
Charcoal Plates	30	0	0	31	10	0
Extra	32	0	0	33	10	0

Coke Tin Sheets 20 Gauge by 36in. specially quoted for. Best Coke Charcoal K Best Charcoal £1 7s. 0d. per box. Extra Coke to Best and Patent Coke £1 10s. 0d. per box. Lattens as to Sheets by 27 W.G. £1 10s. 0d. per ton extra. Packed for Export.

Allowance for cash monthly, 10/-.

Galvanized Corrugated Sheets:

	£	s.	d.	
Best Crown 24 G. 5 ft. Lengths, per	5	0	0	
Basic	11	15	0	per ton
Extra 24 G. in felt-lined	14	7	6	

Galvanized Working Up-Sheets:

	£	s.	d.	
24 G. to 26 G. Crown Best Basic	13	15	0	per ton

STAFFORDSHIRE

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London,

	£	s.	d.	
Crown Bars	6	10	0	per ton
Best Best (1 to 6in. wide, 1/2 to 1in. thick)				
Best Best (1 to 6in. wide, 1/2 to 1in. thick) Plates	7	0	0	
Angles	6	15	0	
Bars	7	5	0	
Tees	7	0	0	
Rounds	7	10	0	
Best Best	8	0	0	
Crown Iron	8	0	0	
Best Best Cross Tees	9	5	0	
Crown	9	5	0	
Special	8	5	0	

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
,, ,, Best Best	9	5	0	,,
,, ,, Treble	10	5	0	,,
Plates	7	10	0	,,
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails, steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.
40 per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound.
40 per cent. off all sharp-pointed nails.
Delivered in lots of 2 cwt. and upwards. Extra 2½ per cent discount off the gross on two tons and upwards.
Steel rose, flat points, 5-inch to 7-inch basis:—
2 tons 9/3 per cwt. } d/d any Railway Station.
Under 2 tons 9/6 per cwt. }

Steel cut nails, 3-inch basis—
2 tons 8/- per cwt. } d/d any Railway Station
Under 2 tons 8/3 per cwt. }
Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:—

	Per Box. f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18¾ by 14 124s. 110 lb. "BV"	0	13	0
C 20 by 10 225s. 155 ,, "Jumbo"	0	18	3
C 20 by 14 112s. 108 ,, "Lydbrook"	0	12	6
C 28 by 20 112s. 216 ,, "Lydbrook"	1	5	3
Charcoal Tinplates:			
C 20 by 14 112s. 108 lb "Allaway"	0	13	3

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

Steel:	£	s.	d.	
Blooms	at 3	12	0	per ton.
Billets	at 3	14	0	,,
Sheet Bars	at 3	16	0	,,
Finished Steel:				
Bars	at 4	16	0	per ton.
Angles	at 4	17	0	,,
Tees	at 4	19	0	,,
Joists	at 4	7	6	,,
Fencing Standards	at 4	19	0	,,
Shoeing Bars	at 5	2	0	,,
Tyre Bars	at 5	4	0	,,
Half-Round Bars	at 5	5	0	,,
Heavy Rails	at 4	10	0	,,
Light Rails	at 4	16	0	,,

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English Ingots, f.o.b. Dis. 1¼ & 1	132	10	0	to	133	0	0	per ton.
English Bars, f.o.b. Dis. 1¼ & 1	133	10	0	to	134	0	0	,,
Straits G.M.B., cash Warehouse, Net	132	0	0	to	132	5	0	,,
Straits G.M.B., 3 months, Warehouse, Net	131	10	0	to	131	15	0	,,
Australian, Mr Bischoff, Warehouse, Net	132	5	0	to	132	15	0	,,

COPPER.

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	68	12	6	to	68	15	0	per ton.
Standard G.M.B., 3 months, Warehouse, Net	69	0	0	to	69	2	6	,,
English, Tough, Cake & Ingot, Warehouses, Net, Dis. 2½%	71	5	0	to	71	15	0	,,
English, Best Select, Warehouse Net, Dis. 2½%	72	10	0	to	73	0	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½	79	0	0	to	79	10	0	,,
English, Sheets for India, f.o.b., Dis. 2½%	76	0	0	to	76	10	0	,,
Electro, Warehouse, Net	70	0	0	to	70	10	0	,,
Ore, ex ship, Net	0	11	9	to	0	12	9	per unit.
Regulus, Matte and Precipitate, ex. ship, Net	0	13	0	to	0	13	6	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%	0	0	6¾	per lb.			
Sheathing ,, ,,	0	0	6¼	,,			

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	25	5	0	to	25	10	0	per ton.
Blende of 50 Net	7	0	0	to	7	10	0	,,
Calamine, Net	7	2	6	to	7	12	6	,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis 2½	13	5	0	to	13	7	6	per ton.
Spanish, ex ship, Dis. 2½	13	0	0	to	13	2	6	,,
Lead Ore of 70, Net	6	11	0	to	6	15	0	,,

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½	37	10	0	to	38	0	0	per ton.
Ore, 50, ex ship, Dis. 2½	8	10	0	to	9	0	0	,,
Crude, ex ship, Dis. 2½	14	0	0	to	15	0	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	15	0	per flask
Italian ,, ,, ,,	7	14	0	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote: Prices per Ton at Pit of 20 Cwts. with ½ Cwt. per Ton for waste:

Upper Main Seam.	s.	d.
Main Coal	7	6
Best Hard Steam Coal picked at Mine to the Railway Company	6	0
Best Hard Steam Coal run through 6 in. mesh, not picked	6	0
Fine Slack	0	6

Terms net [illegible] per month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows per Ton at Pit:

Kilburn Coal:	s.	d.
Best Large Engine	9	0
Large Steam (1½ inch)	9	6
Small Nuts (1 to ½)	6	0
Best Brights	6	0
Large (½ to ¾)	5	0
Small	3	6
Slack	2	0

Low Main (or Tupton) Coal:		
Low Main Brights	7	6
,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Large Steam Coal	[illegible]	
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, [illegible]

	per Ton at Pit. s.	d.
Best Main Coal	10	0
Best Hard Coal	10	0
Best Hard Nuts	[illegible]	
Best Hard Small Nuts	[illegible]	
Best Engine Fuel	[illegible]	
Best Coke	[illegible]	

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham.

Digby Coal:		
Best Hard Steam Coal	[illegible]	
Hard	[illegible]	
Engine	[illegible]	

Gedling Colliery.		
Best Hard	12	0
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	
Best Slack	[illegible]	
Small Slack	[illegible]	
Coke	[illegible]	

CHEMICALS AND OILS.

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

	£	s.	d.	
Acids: [illegible]	0	0	2½	per lb.
[illegible] Crystals	0	0	11	,,
[illegible] at Manchester	0	0	10½	,,
Acetate of Lime: Brown at Manchester net	8	5	0	per ton
Grey	11	0	0	,,
Alumina: Sulphate, Lump	5	5	0	,,
[illegible]	5	7	6	,,
Ground, [illegible]	5	15	0	,,
Sulphate of Ammonia, 14	14	10	0	,,
Ammonia: Carbonate	0	0	3½	per lb.
Muriate Grey f.o.b. Liverpool	24	0	0	per ton
[illegible] Lump 1st [illegible] K.	42	0	0	,,
[illegible] 2nds	40	0	0	,,
[illegible] Liverpool	12	15	0	,,
Arsenic: Best White Powdered net	12	0	0	,,
Bleaching Powder, [illegible]	4	2	6	,,
Borax: [illegible] Refined Crystal	12	0	0	,,

Coal Tar Products:				
[illegible] 50/90	0	0	8	per gal.
90	0	0	9½	,,
[illegible] Acid Crystal, 34/35 C	0	0	6½	per lb.
[illegible] 39/40 C.	0	0	7½	,,
Lizard 97/99	0	0	9	per gal.
Creosote 62½ at 60 F. f.o.b.	0	2	2	,,
[illegible] ordinary neat liquid	0	0	1¼	,,
Naphtha, Crude 20/25 120 C	0	0	3	,,
[illegible] 90/95 at 160 C	0	0	8	,,
[illegible] 95/97½ at 160 C	0	0	9½	,,
[illegible] 90/95 at 160 C	0	0	10½	,,
Rectified, [illegible] 75/85 f.o.b.	0	0	11	,,
[illegible] 100 F. f.o.b.	0	1	0	,,
[illegible] f.o.r. Manchester	1	11	0	per ton
Copperas [illegible]	0	12	6	,,
[illegible]	1	13	0	,,
[illegible]	1	2	6	,,
Copper [illegible]	22	10	0	,,
Cyanides [illegible]	0	0	8	per lb.
Lead [illegible] White, Dry	27	10	0	per ton
[illegible]	24	15	0	,,
Grey	22	0	0	,,
[illegible] Minium	19	10	0	,,
Nitrate	22	0	0	,,
[illegible] Oxide	18	10	0	,,
[illegible]	21	0	0	,,
[illegible]	[illegible]			
[illegible]	18	10	0	
[illegible]	19	15	0	
Naphtha (Wood): Miscible 60 [illegible]	0	2	10	per gal.
[illegible]	0	2	7	,,
Potash [illegible]	0	0	3	per lb.
[illegible] Hull	18	0	0	per ton
[illegible]	20	10	0	,,
[illegible]	0	0	3½	per lb.
[illegible] Spot, Liverpool	0	0	0	per ton
[illegible] Yorkshire	0	0	1½	per lb.

		£	s.	d.	
Soda:	Ash, Caustic, 48 %, Ordinary ...	5	5	0	per ton.
	,, ,, ,, Refined..... ,,	6	5	0	,,
	,, Carbonated, 48 %..... ,,	5	10	0	,,
	,, ,, 58 % (Ammonia Alkali) ..net	4	10	0	,,
	,, Bleachers' Refined Caustic 50/52 %..... net	6	10	0	,,
	Caustic, White, 77 %..... ,,	10	10	0	,,
	,, ,, 70 %..... ,,	9	12	6	,,
	,, ,, 60 %..... ,,	8	12	6	,,
	,, Cream, 60 %..... ,,	8	10	0	,,
	Crystals, in bags	3	0	0	,,
	,, barrels	3	7	6	,,
	Acetate ..... c.i.f. Hull net	16	10	0	,,
	Bicarbonate, in 1 cwt. kegs.....	6	15	0	,,
	Bichromate.....delivered England...	0	0	2½	per lb.
	Chlorate ..... net	0	0	3 1/16	per lb.
	Nitrate...ex quay Liverpool.	11	0	0	per ton.
	Phosphate	9	5	0	,,
	Prussiate .....net	0	0	3½	per lb.
	Silicate, Solution, 140 Tw.	4	10	0	per ton.
	Sulphate (Glauber Salts).....	1	12	6	,,
	,, (Saltcake, 95%).....	1	15	0	,,
Sulphur:	Recovered	4	15	0	,,
	Roll	6	15	0	,,
	Flowers	7	10	0	,,
Zinc:	Sulphate	6	15	0	,,

MINERALS.

		£	s.	d.	
Barytes:	Lump Carbonate, 90/92%.	3	10	0	per ton.
	Sulphate, No. 1, White	2	15	0	,,
China Clay:	of various qualities for all purposes; prices from about 11/– to about 30/– per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore:	Basis 50% c.i.f. British Ports	3	7	6	,,
Manganese:	Lump c.i.f. Liverpool 10½d.	per metallic unit.			
Ochre:	French JC ..... f.o.b. Rouen, net	2	5	0	per ton.
	,, JF	5	10	0	,,
Talc:	(French Chalk).....c.i.f. Liverpool	3	10	0	,,

OILS, etc.

		£	s.	d.	
Aniline Oil	.....net	0	0	4¼	per lb.
,, **Salt**	.....	0	0	1½	,,
Castor Oil:	French, 1st pressure, f.o.b. Marseilles less 1½ ..	20	0	0	per ton.
	English, 1st pressure, f.o.r. Hull, less 2½	21	15	0	,,
Cocoa Nut Oil:	Ceylon, ex store Manchester.....net	31	10	0	,,
	Cochin, ex store Manchester ..... net	33	0	0	,,
Cotton Seed Oil:	Refined at Hull, less 2½ naked	14	17	6	,,
	Edible...at Hull, less 2½% naked ...	15	7	6	,,
Glycerine:	Crude, 80% ..... net	31	0	0	,,
Linseed Oil:	Raw.....at Hull, less 2½% naked	13	10	0	,,
	Boiled ... at Hull less 2½ naked	14	10	0	,,
Starch:	American Pearl...at Manchester, net	9	0	0	,,
	Dextrine..... ,, ,,	18	0	0	,,
	Farina..... ,, ,,	15	15	0	,,
Shellac:	Fair TN orange.....at	185/-			
Turpentine:	American... at Liverpool	38	10	0	per ton
	Russian .....at Hull...net	18	10	0	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to 0	3	0	
Quebec Waney Board Pine...	,,	0	2	8	0	3	9	
St. John Pine, 18 in. average	,,	0	2	3	0	3	3	
Lower Ports Pine.....	,,	0	1	3	0	1	8	
Quebec Red Pine	,,	0	1	6	0	1	10	
Quebec Oak, 1st quality	,,	0	2	9	0	3	3	
Quebec Oak, 2nd quality ...	,,	0	1	6	0	2	6	
Ash	,,	0	1	6	0	2	3	
Elm	,,	0	3	0	0	3	6	
Hickory	,,	0	2	0	0	2	6	
Quebec Birch	,,	0	1	6	0	2	8	
St. John Birch ...	,,	0	1	6	0	2	0	
Birch Planks.....	,,	0	0	9	0	0	11	
Spruce Spars ...	,,	0	0	10	0	1	0	
Deals.								
1st quality Quebec Pine ...	per std.	22	10	0	to 32	10	0	
2nd do. do. ..	,,	17	0	0	22	0	0	
3rd do. do ...	,,	11	10	0	13	0	0	
St. John, N.B., etc., Spruce	,,	6	10	0	6	15	0	
Lower Ports Spruce...	,,	6	0	0	6	10	0	
Spruce Boards.....	,,	5	10	0	6	0	0	

UNITED STATES, etc., WOODS.

Pitch Pine.		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	3	to 0	1	8	
Sawn	,,	0	0	10	0	1	6	
Planks, Stowage	,,	0	0	10	0	1	0	
Boards, Prime	per std.	12	10	0	16	0	0	
Oak Timber	per cub. ft.	0	1	6	0	2	6	
Oak Planks	,,	0	1	6	0	2	1	
East India Teak.....	per load	12	0	0	15	0	0	
Greenheart.....	,,	6	15	0	7	10	0	

EUROPEAN WOODS.

Timber.		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	9	to 0	2	3	
Dantzic and Memel Fir. Crown	,,	0	2	1	0	2	6	
Dantzic and Memel Fir. Middling	,,	0	1	9	0	1	10	
Stettin	,,	0	1	9	0	1	11	
Swedish	,,	0	1	2	0	1	4	
Riga Whitewood ...	,,	0	1	3	0	1	6	
Norway Mining Timber .	,,	0	0	9	0	0	10	
Dantzic and Stettin, etc., Oak.	,,	0	2	6	0	3	0	
Norway Spars	,,	0	1	2	0	1	9	
Deals.								
Red Archangel and Onega, 1st quality	per std.	19	0	0	20	0	0	
Red Archangel and Onega, 2nd quality	,,	16	0	0	17	10	0	
Red Archangel and Onega, 3rd quality	,,	12	10	0	15	0	0	
St. Petersburg, 1st quality	,,	16	0	0	17	10	0	
Do. 2nd	,,	14	0	0	15	0	0	
Gefle	,,	14	0	0	17	10	0	
Wyburg	,,	12	10	0	14	0	0	
Uleaborg	,,	12	10	0	14	10	0	
Gothenburg	,,	14	0	0	17	10	0	

SELECTED PATENTS.

Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C., ar

NEW PATENTS APPLIED FOR.

27,645. A. H. R. Pope, Bristol.

27,669. W. H. Chipperfield, London.

27,728. A. J. Boult, London. D
(N.S.)

27,729. A. J. Boult, London.

27,731. R. F. Carey, London.

27,734. H. Soar, London.

27,750. P. Goldmann, London.

27,769. R. A. Griffiths and H. Mills, Birmingham.

27,777. R. E. Atkinson, London.

27,815. W. F. Probert, Bristol.

27,847. L. Karzenstein, London.

27,875. Aktiebolaget Separator, London.

27,876. Aktiebolaget Separator, London. D

27,877. The Hydroleum Motor Company, Ltd., and J. Badger, London

27,878. The Hydroleum Motor Company, Ltd., and J. Badger, London.

27,880. W. O. Duntley, London.

27,883 A. L. Davis, London

27,924 T. Scully, Waterford.

27,928 C. W. S. Turner, London.

27,935 H. E. Baly, Norfolk.

27,945 S. W. Alsey, Bradford.

27,961 M. S. Sacher and C. Ricci, London.

27,999 G. Machlet, London.

28,005 A. B. Kress, London

28,030 W. Boardmore and E. Field, London.

28,092 F. Day and R. Mills, Blackheath.

28,097. F. Sacchi, London.

28,106. A. J. Boult, London. Dec. 22nd.—Improvements

28,174. W. J. Pickering, Birmingham.

28,185. W. Baur, Germany.

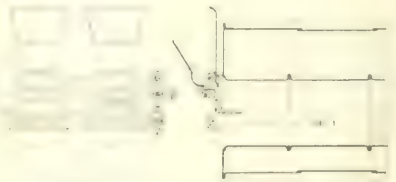
28,204. T. E. Barralet, London.

28,231. J. R. Park, London.

RECENT SPECIFICATIONS.

STEAM GENERATORS.

J. Hodgkinson, Manchester.



METALS AND ALLOYS.

Marquis Albert de Dion and Georges Bouton, Puteaux, France.

GOVERNORS.

The British Thomson-Houston Company, Ltd., and F. Samuelson, London. Jan. 26th, 1904. The invention relates to emergency governing devices for steam turbines, electrical or other machines of the type in which a centrifugally operating governing device is employed to effect the release of an automatically acting valve or other controlling device, so that the power supplied to the machine or current delivered from the machine in the case of an electric generator is automatically cut off when the speed becomes

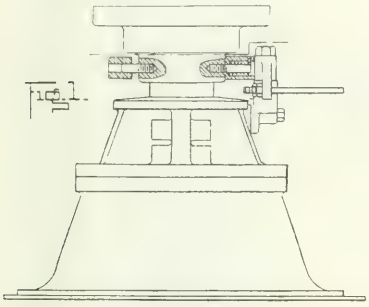
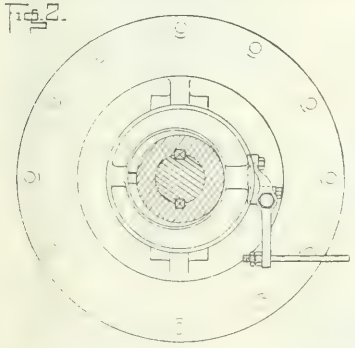


Fig. 2.

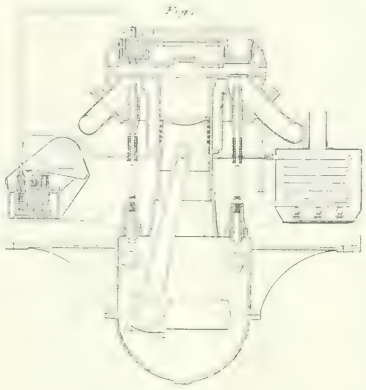


excessive. The device consists of an unequally distributed mass arranged about a revolving shaft, the outer surface of this mass being yieldingly maintained concentric with the shaft at normal speeds of rotation by means of a spring, but adapted to assume an eccentric position and thereby to operate a controlling device. This eccentric movement is utilised through a pivotted member and suitable link mechanism to operate the releasing gear of an automatic valve operating device or other apparatus controlling the supply of power to or from the machine, when the speed exceeds the normal.

OIL ENGINES.

J. E. Thornycroft and T. Thornycroft, Chiswick. Nov. 30th, 1903.—According to this invention, in order to increase the efficiency and improve the working of oil engines, and also to obviate to some extent the great waste of heat that usually takes place therein by reason of the necessity of water jacketing the combustion chambers and engine cylinders, the oil used to form, in conjunction with the air, a combustible mixture, is forced into the combustion chamber of the engine by means of high pressure steam which when the combustible mixture of air and oil is exploded, will, by the absorption of some of the excess heat of combustion, be further increased in pressure, and by admixture with the products of combustion and hot gases will form a more effective motive fluid for working the engine than products of combustion and hot gases alone as heretofore. The invention consists in an oil engine, wherein the oil used to form in conjunction with air a combustible mixture is forced into the combustion chamber of the engine by means of high pressure steam from a steam generator or by heat from the hot exhaust gases of the engine, the supply of oil and steam to the combustion chamber being controlled by a valve device comprising a valve casing connected to an oil pump and to a steam generator, and

Fig. 1.



a valve arranged to control the passage of the oil and steam from the valve device to the combustion chamber, the arrangement being such that when the valve opens, oil supplied by the pump will be blown or sprayed into the combustion chamber by the steam.

CALENDARS AND DIARIES.

The British Steam Specialities, Ltd., of Fleet Street, Leicester, and 73, Farringdon Road, London, forward a neatly bound pocket diary for 1905. A quantity of postal and other information, tables for the use of engineers, price lists of steam traps, valves, "Royal Gem" boilers, wrought-iron tubes and fittings and ventilating grates, etc., have been included.

We have received from Messrs. W. T. Glover and Co., Ltd., of Trafford Park, Manchester, their third annual tear-off sheet almanack. This is mainly composed of extracts from the Proceedings of the Institution of Electrical Engineers, and the Incorporated Municipal Electrical Association. Photographs of a number of prominent central station engineers have also been included, together with views of main laying, etc., and original contributions. All these are carefully interspersed, so that users can turn to Messrs. Glover's calendar with the certainty that every day there will be something new.

Messrs. Gordon and Gotch, Publishers' Agents and Export Merchants, send us a substantial folding blotting pad bound in dark crimson gilt. This is particularly useful to engineers, as on one side there is a neat envelope and pad with squared paper, while bound to the right-hand side with a silken cord is an "Every hour" diary for 1905.

Messrs. Kramos, Ltd., of Bath, forward their showcard for 1905. This firm is making a speciality of electric drills for high speed tool steel, electric lifting blocks, special motor combinations and "Kramos" patent resistance pieces. We have also received list No. 2 of the firm's High-speed Electric Drilling Machines.

Messrs. Shand, Mason and Co., of 75, Upper Ground [illegible] appliances.

Walter Judd, Ltd., Advertising Contractors, of 5, Queen [illegible] been issued by this [illegible].

[illegible] we have also to acknowledge the receipt of a wall sheet [illegible] Lane, Old Bailey, E.C.

[illegible] issued a novel calendar, the groundwork of which is a [illegible] known as perpetual, and as it is mounted on tin, should [illegible].

[illegible] a well-mounted wall calendar in green and gilt with a tear-off slip for each month from January 1905 [illegible].

[illegible] 13, Boulevard Malesherbes, Paris, forward a [illegible] calendar, printed in bright colours, and illustrative of their rail and motor-car specialities.

[illegible] Partridge and Cooper, Ltd., forward a selection [illegible].

NEW PUBLICATIONS.

THE ELECTRIC FURNACE.

[illegible] admirably produced volume describes the different types of furnaces utilised in these researches, [illegible] Chapter II. [illegible] following [illegible].

"ELECTRICITY IN THE SERVICE OF MAN."

[illegible] cannot scarcely be regarded as a second edition, there being every evidence that it has been entirely re-arranged and rewritten. The scope of Dr. Walmsley's work is very extensive and we know [illegible] comprehensive account of the rapid growth of electrical [illegible] The writer deals with this subject under the following heads: principles [illegible] current; the magnetic effect of the current [illegible] circuits; the electric telegraph; magnetic electric induction [illegible] electric transmission of power; electric motors; alternate [illegible] technology of electricity; continuous current generators; alternators; batteries of generators; continuous current [illegible] illustrated and contains a number of folding, detailed drawings.

NEW CATALOGUES.

The Pulsometer Engineering Company, Ltd., [illegible]

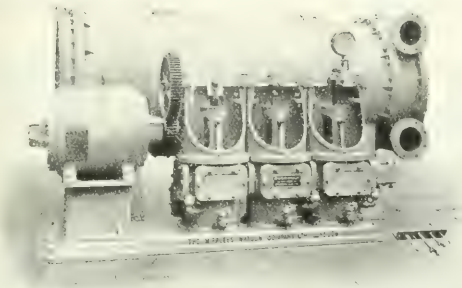
Messrs. Mather and Platt, Ltd., have just issued a second edition of their Polyphase Motors catalogue.

We have received from the Lodge and Shipley Machine Tool Company, [illegible] patent head lathe.

The Mirrlees Watson Company, Ltd., [illegible] forward an attractive and artistic pamphlet dealing [illegible] exhaust steam per hour. Some attractive photographic illustrations and diagrams are included.

MEETINGS FOR THE ENSUING WEEK.

[illegible]



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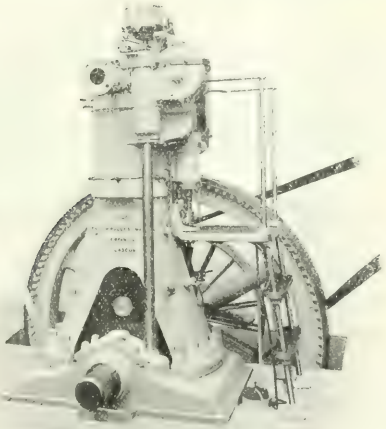

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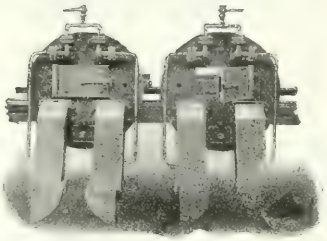

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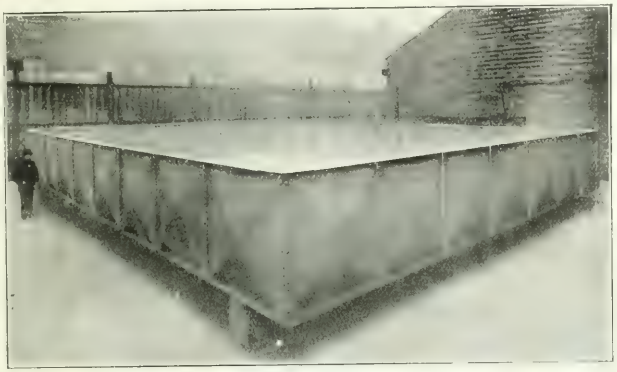

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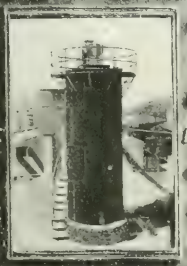

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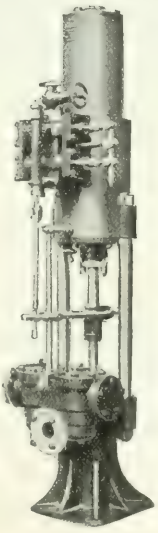

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